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ABSTRACTS

PAPERS TO BE PRESENTED

1. Further evidence concerning the menstrual cycle of the monkey, Macacus rhesus. EDGAR ALLEN, Department of Anatomy, University of Missouri.

A histological study has been completed of genital tissues from normal, ovariectomized control and experimental animals in which menstrual cycles had been induced by injections of ovarian and placental hormones (Anat. Rec., vol. 32, p. 226).

Correlation of ovarian structures with menstrual histories confirms Corner's evidence of the sequence of menstrual cycles in the absence of ovulation and corpus-luteum formation.

Injections of hormone were made twice daily into ovariectomized adults over periods varying from ten to fourteen days. The total dosage in the later experiments ranged from 190 to 230 'rat units.' These amounts of active substance caused extreme reddening of the 'sexual skin' and rapid hyperplasia of the

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genital tissues. The vaginal epithelium was much thickened and the outer layers were partly cornified. The uterine mucosa, especially the glandular elements, showed marked growth. Mitoses in the tubal epithelium indicated repair of castrate atrophy. The epidermis of the nipple was thickened and the ducts and alveoli of the mammary gland had grown and branched.

These results demonstrate that the follicle is the seat of production of the essential hormone in the mechanism of the menstrual cycle. Endocrine activity of the corpus luteum is not a necessary factor. The human placenta contains a similar substance. After hormonal action induces a certain amount of growth in the genital organs, its withdrawal or decrease precedes menstruation.

2. Studies on the cortical and superior colliculus respiratory pathways in the spinal cord. WILLIAM F. ALLEN, Department of Anatomy, University of Oregon.

Stimulation of the motor cortex produced a definite respiratory reaction. Stimulation of the superior colliculi resulted in a very different respiratory tracing, including a marked hind-leg response. No cortical area stimulated elicited a hind-leg response, and extensive cortical lesions caused no paralysis of the hind leg.

The following lesions in the upper cervical region of the rabbit failed to block impulses from either cerebral hemisphere or superior colliculus to the respiratory motor nucleus in the cord, or the superior colliculus hind-leg response: *a*) Complete hemisection of the spinal cord and severance of the median division of the anterior column on the opposite side; *b*) complete severance of both anterior columns; *c*) complete severance of the lateral columns.

To completely stop the superior colliculus hind-leg response required a lesion in the lower thoracic cord, which involved both anterior columns and the median half of the lateral columns. Such a lesion in the upper cervical region would instantly stop respiration.

These and other experiments indicated not only that the above-mentioned impulses are conducted in the anterior columns and in the ventral half of the lateral columns of the cord, but that they are propagated by both the ventral and the lateral reticulospinal fibers; the corticospinal and tectospinal fibers apparently taking no part, other than to conduct these impulses to the formatio reticularis of the medulla and pons.

3. The comparative anatomy of the lips and labial villi. BARRY J. ANSON, Northwestern University Medical School.

In a further search for homologies of mammalian lips and labial villi, 255 sagittal series in the Harvard Collection and over 800 whole specimens and special preparations have now been examined.

It is found that lips are recurrent features among the vertebrates, appearing first in elasmobranchs; lips with definite epithelial zones—one of them villous—are observed in the cod and toadfish; in the former the villi bear numerous taste-buds. The tuberculated or villous labial and gingival areas in the Catastomidae are similarly beset with gustatory organs. A comparison will be made between the lips of fishes and those of man, cat, ruminant, and rodent. Less comparable are the terminal lips of amphibians, and the scale-clad labial folds of reptiles generally, which bear neither villous outgrowths nor sense organs.

Epidermal thickenings about the oral orifice are also recurrent morphological features. Thus, in the newborn rat and mouse, as in the 'larval' Ornithorhynchus, a labiogingival pad retards the appearance of labial structures, so that these young mammals are without lips. Such cornifications suggest the permanent horny beak of birds and chelonians, as well as the armament of the larval anurans and the epidermal teeth of cyclostomes; in both of the latter groups a sensory fringe occurs beyond the horny eminences, duplicating the succession of villi and teeth, observed in man and other mammals.

4. The human uterine gland cell. G. W. BARTELMEZ, University of Chicago.

A survey has been made of 300 uteri opened immediately after removal at operation and fixed in different ways. In sixty-three cases the mucous membrane appeared normal histologically or had normal areas. Many infected specimens were also available for study, as the gland cells differ from the normal only in that secretory activity is accentuated. Most of the uteri were fixed in aqueous chrom-sublimate; in fifty-five cases blocks of the same organ were prepared by six or more methods. Two phases of secretory activity are recognized. The first is characteristic of the early interval when the rate of secretion appears to be slow, the cells show no striking changes in form and the secretion has but little coagulable material. Toward the end of the stage of proliferation, secretion antecedents of the second phase appear, the cell as a whole and its organs undergo characteristic changes. In some cases at least, secretory activity has practically ceased at the time the menstrual extravasation has begun.

5. Morphological changes in the central nervous system and endocrine glands of rabbits exhausted by loss of sleep. T. H. BAST, Department of Anatomy, University of Wisconsin.

Rabbits were placed in revolving cages which by the aid of electric motors were revolved at the rate of 1.1 revolution per minute. This speed was sufficient to make the animals change their position eight to ten times per minute, and thus did not allow them to go to sleep. The cages were equipped with hanging containers which at all times contained water and food. The animals were run until they were exhausted, which varied in the different animals from eight to thirty-one days. During their final convulsive attack, the animals were sacrificed by carotid bleeding. Histological examinations were made of the organs. Only the results of the medulla, spinal cord, adrenal, and thyroid gland are herewith reported. The conclusions of these studies are:

1. Chromatolysis of nerve cells does occur during extreme fatigue.

2. This chromatolysis consists, first, in a breaking up of the Nissl bodies into granules; second, vacuolization of the cytoplasm and, third, actual decrease of Nissl substance.

3. In the adrenal the changes consisted of, first, a vacuolization of the cortical cells; second, clusters of eosinophiles in the cortical sinuses, and, third, the sinuses and veins of the medulla contain a colloid-like substance.

4. In the thyroid the most outstanding change is the marked decrease in mitochondria.

6. *The anatomy of the Tela subcutanea.* O. V. Batson, Department of Anatomy, University of Cincinnati.

The ways in which the retinacula cutis are distributed have been variously described—usually on a histological basis. Sometimes these retinacula have been recognized as sheets such as the fascia of Scarpa. The laminae seem to vary with the particular observer.

I have found that the fibers of the tela subcutanea are really a supporting mechanism developed in response to the stimulus of the weight of the skin and of the subcutaneous fat. The supporting fibers are arranged in sheets (such as the fascia of Scarpa), and from these sheets extend fibers (retinacula cutis) ending in the corium.

The fibers of the corium represent a direct continuation of the fibers of the tela. Therefore, the cleavage lines of von Langer indicate not only the direction of the corium fibers, but also the direction of the fibers of the underlying tela subcutanea. The fibers of the tela subcutanea, then, and the fibers of the corium as well, are shown to be present in response to a functional demand and to follow the laws of fibrous bands found elsewhere in the organism.

7. *Glycogen in the human uterine mucous membrane.* C. M. Bensley (introduced by G. W. Bartelmez), University of Chicago.

The distribution of glycogen has been studied in fifty-five specimens from hysterectomies. The extreme plasmolysis produced by alcohol fixation was reduced by adding one part of formol 'neutralized' with $MgCO_3$ to nine parts of absolute alcohol. Fixation must be prompt, as the glycogen is very labile. Aqueous fixatives containing formol or biochromate preserve it only at the surface of the blocks of tissue. In every case sections have been tested with Lugol's solution as well as with Best's carmine and controlled with sections digested with saliva. Glycogen has also been extracted from the mucous membrane and identified chemically. The presence of glycogen in gland cells, stroma cells, intercellular substance, and leucocytes is confirmed. It may also occur in the plasma cells of pus-tube cases. When it first appears toward the end of the interval, it is found in the bases of the gland cells; but in later stages, in areas which appear free from plasmolysis, its distribution is very variable. Usually it appears in the form of droplets of various sizes, variously located; occasionally it is diffused throughout the cell. The secretion blobs do not always contain it, but it is a characteristic component of the secretion in the pregravid phase.

8. *A study upon the placental permeability of the white rat, as determined by its reactions to hemolysins.* Charles M. Boucek (introduced by J. S. Nicholas), Department of Anatomy, School of Medicine, University of Pittsburgh.

An immune serum hemolysin produced in the albino rat against guinea-pig corpuscles and injected into fourteen- to nineteen-day-old foetuses cannot be demonstrated in either the general circulation or the uterine-vein blood of the mother.

The hemolysin disappears rapidly and cannot be recovered in measurable quantity from the foetus after forty-eight hours. Its disappearance is not due

to placental absorption, but to some regulatory mechanism acting in both foetus and placenta which, in some way, destroys, neutralizes, or changes the hemolysin.

Hemolysin actively produced in female rats against guinea-pig corpuscles is not passed to subsequent litters through the placenta. Natural hemolysins against guinea-pig corpuscles were found in several mothers, but in no case were these transmitted to the foetus through the placenta.

The placentation of the white rat is of such a nature that it acts as a barrier to the passage either from foetus to mother or from mother to foetus of natural hemolysin and of both actively and passively acquired white-rat-guinea-pig hemolysin.

9. A new method of estimating the surface area of the living subject applied to children. EDITH BOYD and RICHARD E. SCAMMON, Institute of Child Welfare and Department of Anatomy, University of Minnesota.

With the exception of the work of Du Bois, practically all determinations of the surface area of the human body have been made from cadavera, and include the defects inherent in this material. The observations of Du Bois include no individuals of the first decade.

The method developed for this study involved: 1) making a complete plaster-of-Paris cast of the living child; 2) covering this cast with non-elastic zinc oxide adhesive plaster; 3) removal of this plaster and tracing of its area on celluloid sheets ("Kodaloid no. 3"); 4) determination of the area of the celluloid outlines by weighing on an analytic balance.

Nine casts of, and seven determinations of, area have been made of children ranging from three to five years in age. The determinations have been repeated three times on two of the casts. The variability in repeated determinations of surface areas by this method lies between 1 and 2 per cent. The experimental error is of no greater magnitude.

Along with this experiment, a large number of determinations of the surface areas of these subjects have been made by means of Du Bois' height-weight and lineal formulae. Our determinations of surface areas from casts tend to be slightly higher than the values as calculated from Du Bois' formulae. So far our determinations have shown less variability than do the values obtained by various permutations of the Du Bois' formulae.

10. The elimination of waste products in chick embryos. EDWARD A. BOYDEN, Department of Anatomy, University of Illinois, and CYRUS H. FISKE, Department of Biochemistry, Harvard Medical School.

In a recent cooperative study of the mesonephros—the first in which modern microchemical methods have been employed in analyzing the allantoic fluid—the joint authors were able to demonstrate that uric acid is the only nitrogenous waste product eliminated by the embryonic kidneys during approximately the first two weeks of incubation (Jour. Biol. Chem., Oct., 1926). The present study is an attempt to correlate these chemical findings with the morphological development of the wolffian body. To this end, wax models of the mesonephric tubules have been prepared, covering the fifth to the fifteenth day of incubation. Incidentally, these exhibit a different morphological pattern than is found in the tubules of any other warm-blooded vertebrate hitherto modeled. One of the

most striking features in the development of the chick tubule is the marked growth between the twelfth and the fifteenth days—a period in which it has been supposed that the mesonephros was rapidly degenerating. It is hoped that the completed study of these tubules (of which this is merely a preliminary report) may throw some light on the relative importance of glomerulus and tubule as agents in the elimination of uric acid.

11. Studies in the dynamics of histogenesis. XII. The regeneration of the patellae of dogs. Eben J. Carey, Walter Zeit, and Bernard F. McGrath, Department of Anatomy and Surgical Laboratories, Marquette University.

In the following experiments, begun April, 1922, a total of eighteen puppies had their right patellae removed. The tendons of the quadriceps extensor muscles were sutured to the patellar ligaments. The operated limbs were in plaster casts for three to four days and then the puppies were allowed to run about. The earliest stage at which bone was regenerated and detected by the x-ray was thirteen days after the operation. The x-ray findings were checked histologically. Cartilage and bone regenerated as long as the knee-joint was movable.

In four puppies the knee-joints were fixed, the patellae excised and the quadriceps tendons and patellar ligaments sutured together. In this series no patella, cartilage, or bone regenerated.

In four puppies the knee-joints were fixed and the patellae left intact. In this series of experiments the patellae lost progressively their shadow-casting properties on the x-ray film, whereas the unoperated legs had patellae which increased their density as growth continued.

The conclusion is made that the internal structure of cartilage, bone, and the external form of the patellae of puppies will regenerate as long as the knee-joints are normally movable, provided the suturing of the quadriceps extensor tendons and the patellar ligaments does not cut off the blood supply to the regenerating zone.

12. An inquiry into the phylogenetic basis of the flexuous arteria carotis interna of man. (The arteriae carotides of the seal.) A. G. Carmel (introduced by O. V. Batson), Department of Anatomy, University of Cincinnati.

Marked curvatures are frequently seen in the arteria carotis interna in man. Some consider these due to arterial disease, others to a congenital condition representing a reversion to a lower type. The seal is named as the lower type normally having a tortuous carotid artery, authority for this being Chauveau-Arloing's statement that the carotid artery in this animal is forty times longer than the space it has to traverse.

Specimens have been dissected and the literature has been searched in order to ascertain whether Chauveau-Arloing's statement is substantiated. No other reference to tortuosity of any of the carotid arteries in the seal has been found. The dissected specimens reveal vessels remarkable for their direct courses. A complete circulus arteriosus formed by branches from the aa. vertebrales and carotides internae is present.

Chauveau-Arloing's statement regarding the tortuosity of the carotid artery in the seal is not borne out, and therefore the phylogenetic significance of curvatures in the a. carotis interna of man is questioned.

13. Ossification of the bones of the hand. THOMAS M. CARTER (introduced by B. C. H. Harvey), University of Chicago.

Six hundred healthy children were selected from the University Elementary School and x-ray photographs made of their hands. A uniform method was followed. Ages five to seventeen were included and all photographs were made within a week of the children's birthdays. The total area of each wrist was measured and also the total area of ossification within it, and thus comparable percentages were obtained for each age notwithstanding individual differences in size. These photographs show, 1) The normal progress of ossification through ages five to seventeen. 2) The range of variation. 3) The difference in bone growth in the two sexes. 4) Some inconstant elements, such as distal epiphyses of first metacarpal bones, proximal epiphyses of second and fifth metacarpal bones, fused and double carpal bones, os centrale, and other occasional carpal elements.

14 a. The relation of parathyroidectomy to pregnancy, lactation, and the growth of offspring in albino rats. SIMON B. CHANDLER (introduced by R. M. Strong), Loyola University School of Medicine, Chicago.

The parathyroid glands were removed from albino rats between the ages of seventy-five and one hundred days. The animals were given from two to three weeks to recover from the effects of the operation and then mated with both normal and parathyroidectomized animals.

A standard diet was used, with a liberal supply of meat every other day. Ten litters have been secured. One female died twenty-three days after mating. She had seven fetuses near term. The offspring of four other females died soon after birth or were eaten. The mothers apparently were unable to care for their young in these four cases. The weight of many of the offspring at birth is a little less than the normal, being about 4 grams in most litters. Growth is very much retarded in some litters or individuals, but if the young animals survive the lactation period, normal weight is usually attained in less than one week after weaning.

14 b. The healing of fractures in parathyroidectomized albino rats. SIMON B. CHANDLER (introduced by R. M. Strong), Loyola University School of Medicine, Chicago.

The parathyroid glands have been removed from a series of albino rats. One bone of a fore limb was fractured at the time of the operation and the fracture region studied histologically at ten, fourteen, and twenty-one days after operation. The age of the animals used ranged from fifty-five days to ninety days.

Litter mates were used as control animals. Calcium determinations showed about 10 mg. per 100 cc. of blood plasma in the unoperated and about 5 mg. in the operated animals. No significant differences in healing have been found in the two groups.

15. On the intravascular phagocytosis of erythrocytes. ELIOT R. CLARK and ELEANOR LINTON CLARK, Laboratory of Anatomy, Medical Department, University of Pennsylvania.

In previous studies on living cells in the transparent tails of tadpoles we found that phagocytosis of extravascular erythrocytes by pigmented wandering

cells (macrophages) never occurs until the erythrocytes have been at least fifteen hours outside the capillaries, showing that erythrocytes must undergo a change before they are susceptible to phagocytosis.

Recently, phagocytosis of erythrocytes by the same type of cell. inside the capillaries, was observed. Macrophages from the tissues were seen to collect around non-circulating capillaries, to pass through the wall into the lumen, and there to ingest abnormal erythrocytes. Furthermore, in a tadpole in which about 4 per cent of the circulating erythrocytes showed visible abnormal changes, as a macrophage was observed moving along the inner wall of a capillary through which blood was circulating, it was seen that all normal-appearing erythrocytes moved past the macrophage without the slightest tendency to adhere, but that every abnormal erythrocyte showed a decided stickiness toward the macrophage. Soon, several such cells adhered to the macrophage, the circulation was blocked and the macrophage ingested the cells adherent to it. Later, this performance was repeated.

It is evident that intra- as well as extra-vascular phagocytosis of erythrocytes occurs and that susceptibility to phagocytosis is associated with a change in the erythrocyte which makes it sticky toward the macrophage.

16. Motion pictures illustrating the movements of the deafferented hind leg of the cat. S. L. Clark and S. W. Ranson, Washington University, St. Louis.

If the dorsal roots of one lumbosacral plexus are cut close to the spinal cord, the corresponding hind limb becomes atonic for about twenty-four hours. Later, there usually develops a marked overaction of the extensor muscles, which reaches its height about one week after the operation and then gradually subsides. Pinching the toes of the opposite foot causes a vigorous crossed extensor reflex. Considerable resistance develops to passive flexion of the leg which, at least in some instances, persists after the animal is killed with an overdose of ether, showing that the extensor muscles are in a state of contracture.

The factors responsible for this spasticity have not yet been satisfactorily determined. The cutting off of inhibitory afferent impulses coming from the leg seems to be of importance in allowing the overaction of the extensor muscles to develop. Removal of the spinal ganglia prevents the development of resistance to passive flexion, but it is difficult to exclude temporary impairment of the ventral roots due to trauma in dissecting off the ganglia. Anaemia and resulting vascular lesions of the cord may play a part. But the fact remains that after section of the dorsal roots hypertonus or something which very closely simulates hypertonus develops in the deafferented extensor muscles. This is hard to explain on the basis of any of the theories of muscle tonus.

17. The embryology of the neuromuscular spindles. Fidel Cuajunco (introduced by Lewis H. Weed), Department of Anatomy, Johns Hopkins University.

Biceps muscles of fetal pigs treated in Bielschowsky's silver stain show the differentiation between the motor and sensory innervations at the 45-mm. stage. Primitive neuromuscular spindles consist of undifferentiated muscle fibers surrounded by loose plexuses of tenuous nerve fibrils. In subsequent stages these plexuses gradually become more complicated. The nuclei of the enclosed muscle fibers increase in number in a certain zone to become the future equatorial region.

In 80-mm. fetuses membrane-like connective-tissue lamellae surround the groups of primitive intrafusal muscle fibers—the initial formation of the capsule. Gradually the capsule thickens and extends from the equator to ensheath the polar regions. Moreover, the muscle fibers begin to develop wider, much more darkly staining, and more distinctly separated anisotropic bands than the extrafusal fibers.

In 150-mm. fetuses there appears under the capsule in the equatorial region a slit-like space which gradually develops into the periaxial lymph space by the distention of the capsule.

Medullated and non-medullated nerve fibers innervate the neuromuscular spindles. At first ringlets and dot-like enlargements appear along the course and intersections of the plexus forming fibrillar endings on the intrafusal muscle fibers. The enlargements become transformed into variously shaped expansions consisting of a network of delicate nerve fibrillae. Adult forms of neuromuscular spindles are seen from the 170- to 180-mm. stages on.

18. Early stages of the formation of the human pericardial cavity. Carl L. Davis, University of Maryland.

The pericardial cavity in man is formed by fusion of multiple vesicular spaces. In an embryo (Carnegie Collection no. 5080) immediately preceding the marking-off of the first pair of somites the pericardial cavity consists of two large slit-like mesodermal spaces, the product of fused vesicles, and a number of unfused vesicles. These form a nearly continuous horseshoe-shaped cavity circumscribing the head-fold and extending caudally to the level of the first somite. Completion of the fusion forms a single cavity. Subsequent expansion of the cavity (2-to-3-somite stage) may be likened to the opening of the mouth, the axis of rotation passing through the cornua (lateral recesses) of the cavity; the direction of expansion being ventrocaudal and being maximal in the midline. As a result, the cardiogenic plate becomes reversed and progressively approaches the first somite carrying with it the entoderm which becomes the ventral wall of the foregut. Therefore, the expanding pericardial cavity becomes a major factor in the formation of the foregut. This is substantiated by the fact that the position of the pharyngeal membrane, relative to the first somite, remains constant; hence, foregut formation through lengthening of the dorsal pharyngeal wall has not occurred. Secondarily, the expansion of the cavity mechanically pulls the ventral pharyngeal wall ventrally, producing its characteristic keel-like form. This method of pericardial formation precludes the formation of a ventral mesocardium. Through caudal extension, the lateral recesses unite with the exocoelom at about the 7-somite stage.

19. Elasticity and permanent deformation of muscle when stretched by moderate loads. H. H. Dixon and S. W. Ranson, Washington University, St. Louis.

When a muscle deprived of its nerve supply, but with its circulation intact, is slowly stretched by the gradual application of a moderate weight, it increases in length, and when the weight is removed, it does not quite return to its original dimensions. A large part of the increased length is therefore due to elastic stretch and is reversible; the remainder represents a permanent deformation and is irreversible. The elasticity of a muscle is approximately constant, but the capacity for showing permanent deformation, i.e., the ductility (plas-

ticity in the sense of Langelaan) varies greatly under the conditions imposed in these experiments.

If the tendo Achillis is cut and the nerve to the gastrocnemius left intact, that muscle shortens, and within fifteen days becomes permanently fixed in this shortened length; but this contracture does not occur if the sciatic nerve has previously been divided. Tetanus toxin causes a similar permanent shortening of the muscle, which persists after section of the motor nerve or death of the animal. In both instances the elasticity of the muscle remains approximately normal, but the resistance to permanent deformation is greatly increased—i.e., the ductility is correspondingly decreased.

Evidence of the direct action of tetanus toxin on muscle will be presented. The influence of blood supply upon the ductility of normal and pathologically shortened muscle is being studied.

20. On the postnatal growth in the area of the optic nerve in albino and in gray Norway rats. (Observations by Mr. Wang.) HENRY H. DONALDSON, The Wistar Institute, Philadelphia.

It is generally recognized that the visual apparatus in the albino rat is somewhat defective as compared with that in the gray Norway. To obtain more precise information along this line, the area of the cross-section of the optic nerve was determined from birth to maturity in both sexes of these two races. This area is distinctly greater in the gray Norway even after correction for brain size, which is also greater in the gray Norway.

The most marked distinction in area is between the sexes, the female optic nerve having a greater area in both races. The female eyeball is larger than that of the male, but the difference is not quantitatively sufficient to account for the difference in area. On the other hand, the gray Norway, with larger optic areas, has smaller eyeballs than the albino, with smaller areas. An explanation of this relation is lacking.

A study of the number and size of the nerve bundles in the optic nerve leads to the view that the difference in area is due mainly to the number of fibers in the nerve.

21 a. The oestrous cycle in the dog. I. The vaginal smear. HERBERT M. EVANS and HAROLD H. COLE, University of California.

In the dog, corresponding with stages in the oestrous cycle, are characteristic changes in the cell types free in the vaginal lumen. In prooestrum (eight to ten days), the period from first appearance of bleeding to first acceptance of coitus, there appear, in addition to the red cells, great numbers of large, flat cornified cells; these add themselves to the smaller epithelial cells and leucocytes characteristic of anoestrum. By the second or third day of prooestrum, cornified cells and erythrocytes predominate. During the last three or four days of prooestrum they are the only cells present in the smear. In oestrum (seven to ten days), the period stretching from first to last acceptance of coitus, the smear shows cornified cells and erythrocytes only, save for the intrusion of small epithelial cells and leucocytes on the last day or two of the period. In metoestrum (thirty to forty days), which extends from last acceptance to reattainment of the resting state in the genitalia, we have again the small epithelial cells of anoestrum, but at first abundant vestiges of the cornified cells of oestrum and great numbers of leucocytes.

21 b. The oestrous cycle in the dog. II. Coincident changes in the genital organs. HERBERT M. EVANS and HAROLD H. COLE, University of California.

Distinctive changes occur in the vaginal mucosa; at the time of oestrum. The two- or three-cell-layered cylindrical epithelium of anoestrum grows into a high stratified squamous structure by the beginning of prooestrum. At first acceptance, the mucosa has attained its maximum height reduced during oestrum by desquamation of the stratum corneum. By the tenth day of metoestrum the stratified squamous structure has reverted to a low cylindrical one, in pregnant or non-pregnant animals.

An endometrial cycle is likewise distinctive. By the beginning of prooestrum the endometrium is a high edematous structure with extravasation of reds; glandular hypertrophy barely begins. The latter has made evident progress by first acceptance. Marked glandular hyperplasia characterizes the first twenty days of metoestrum even in non-pregnancy (pseudopregnancy). Although variation exists, ovulation occurs near the end of the first day of true oestrum.

22. Sources of stimuli regulating the growth of the mammary glands in the opossum. CHRISTINE EVERS, University of Texas, and CARL HARTMAN, Department of Embryology, Carnegie Institution of Washington.

In pseudopregnancy (eggs unfertilized) mammary glands develop as in pregnancy. Hysterectomy is without influence. Placenta, fetus, and uterus are, therefore, not necessary factors. Yet extract of human placenta is capable of causing pseudopregnant changes. Some growth of the glands is attained before ovulation under the influence of graafian follicles (interstitial tissue is too variable to be considered seriously). 'Folliculin' extract is effective. If ovulation (abnormally) fails to occur, the ripe follicles neither become cystic nor hemorrhagic, but cloudy and opaque, and gradually degenerate; but such follicles are capable of continuing the growth of the mammary glands far beyond the prooestrous stage. Even medium-sized or somewhat less than mature atretic follicles cause appreciable growth changes. Ovariectomy in the dioestrum prevents recurrence of another cycle; yet to our surprise ovariectomy performed within one or two days after ovulation (whether the eggs were fertilized or not) usually failed to inhibit pregnant (or pseudopregnant) changes in the mammary gland. We attribute this extraordinary phenomenon to the momentum attained by the glands up to the time of the operation.

23. Observations on germ-cell origin in the adult male teleost, Umbra limi. JAMES O. FOLEY (introduced by Irving Hardesty), Department of Anatomy, Tulane University.

The evidence indicates that in Umbra spermatogonia are restored to the annually depleted lobules from cells located in the stroma of the testis rather than from cells which have been maintained as a discrete germinal residuum within the lobules. The seasonal crop of spermatogonia is formed mainly by cells which migrate from the stroma into established lobules. However, transformation of stroma cells into spermatogonia occurs to a considerable extent in the fibrous tissue of the testis, resulting in the formation of new lobules. It has been impossible to trace, with certainty, the origin of the spermatogonia beyond

the stroma. If cells do migrate from the mesothelium into the stroma, their identity is lost from this point, and in the determination of the history of stroma cells it is impossible, therefore, to establish a differential origin of those which contribute spermatogonia.

24. Experimental analysis of the cell columns in the cervical enlargement of the albino rat. JOSEPH H. GOERING (introduced by H. C. Tracy), Department of Anatomy, University of Kansas.

The method employed was Nissl degeneration. Each of the following nerves, musculocutaneous, median, ulnar, radial, axillary, suprascapular, and anterior thoracic, was cut in two rats.

The musculocutaneous, median, and ulnar nerves confine their motor cells largely to column C (dorsolateral in the sixth and upper two-thirds of the seventh, dorsomedial in the caudal one-third of the seventh, eighth, and first thoracic segments). Motor cells of the radial nerve are located throughout cell columns D and C′, and in the seventh and eighth segments of column M. Column C′ is in the eighth and first thoracic segments, lateral to column C. The columns M and D extend through the sixth, seventh, eighth, and first thoracic segments; column D is intermediolateral, ventral to columns C and C′, and column M is medial to D. The motor cells of the suprascapular nerve are largely in column M (sixth and probably the fifth segments); of axillary nerve in columns M, D, and C (sixth and seventh segments); of the anterior thoracic nerve in columns S and M (seventh, eighth, and first thoracic segments). Column S is ventral to column D.

Observation indicates that motor cells of the cord are grouped in functional columns correlated with functions of extension, flexion, adduction, abduction, and rotation.

25. On the effect of heat, cold, chemicals on the exposed medulla of the dog. ELISHA S. GURDJIAN, Department of Anatomy, University of Michigan.

This is a preliminary report. Thirteen dogs were used in these experiments. The medulla, a portion of the cerebellum, and a portion of the cervical cord were exposed posteriorly by cautery at each time. Respiration and blood pressure were noted.

The bathing of the dorsal aspect of the medulla with lactic- and carbonic-acid solutions did not affect respirations. Heat at 65° to 75°C. applied to the area surrounding the apex of the calamus scriptorius causes a stoppage of respirations, the latter reappearing as soon as the heat is removed. Strong salts: potassium phosphate, sodium chloride, sodium nitrate, sodium sulphate, when applied to the dorsal aspect of the medulla in the region of the calamus scriptorius, cause an increase in the respiratory rhythm accompanied by changes in the blood pressure. The application of sodium-cyanide crystals to the same area causes a tremendous increase in blood pressure and an increase in respirations. These salts when applied to the dorsal aspect of the cervical cord are not accompanied by any changes. The application of ice to the dorsal aspect of the medulla does not cause appreciable change in our experiments. Slight changes in blood pressure and a slight irregularity of respiratory rhythm have been the most common observations.

26. Menstruation without ovulation in Macacus rhesus: account of an experiment. Carl Hartman, Laboratory of Embryology, Carnegie Institution of Washington, Baltimore.

Monkey no. 21 menstruated October 23rd, November 30th, and January 10th. January 21st, the sex color had deepened and the entire sex skin began to swell. By February 7th the edema had attained tremendous proportions. As monkey no. 12 had previously shown similar edema for about two months and was amenorrheic until this subsided, excessive ovarian secretion, perhaps from cystic follicles, was thought of as a causative factor. Accordingly, laparotomy was performed on M.21, February 11th. Findings: 7-mm. graafian follicle with thick, white, opaque wall; uterus very vascular, dark purple; tubes swollen and turgid. A portion of the follicle was removed. February 14th: sex color and swelling greatly reduced. February 16th: sex skin a sickly pallor, no more swelling at all. February 18th: menstrual flow.

The failure of Heape, van Herwerden, and Corner to find corpora lutea in some menstruating monkeys may be due to the fact that an atretic follicle is sufficient to cause premenstrual growth adequate to result in menstruation upon the removal of the stimulus (Corner, Schickélé). The menstrual flow in our case was associated with no corpus luteum.

27. A physiologic and anatomic consideration of the sphincteric mechanism of the choledochus. G. M. Higgins and F. C. Mann, Mayo Foundation.

Since the earliest description of a separate musculature at the duodenal end of the common duct, studies both physiologic and anatomic have centered upon the existence and functional significance of such a mechanism. Recently, in the train of renewed studies upon the physiology of the gall bladder, the existence of a sphincter has been questioned by those who resort to an older opinion that the tone of the duodenal wall together with peristalsis were major factors in the egress of bile.

To determine the existence of any local mechanism at the duodenal end of the common duct, we inserted a cannula into the upper end of the choledochus and completely dissected the duct away from the duodenum of a dog under ether anesthesia. The intramural portion of the duct was firmly placed on the points of an electrode, while the cannula in the upper portion was connected with a pressure bottle placed at a convenient elevation. Warm Ringer's solution was allowed to pass through the isolated duct and records were made of the rate of flow of the fluid by both the drop and pressure method. It was found that a brief electrical stimulation upon a restricted region of the intramural portion of the duct induced a contraction which stopped the flow of the fluid at a pressure greater than the secretory pressure of the liver or that produced by the contraction of the gall bladder.

28. Observations on the innervation of skeletal muscle. J. C. Hinsey (introduced by S. W. Ranson), Washington University, St. Louis.

In cats the nerve components to skeletal muscle have been isolated: 1) ventral root component to the quadriceps femoris by removing the lumbar sympathetic trunk and the dorsal root ganglia of the spinal nerves supplying the muscle; 2)

dorsal root component to the quadriceps by removing the lumbar sympathetic trunk and cutting the ventral roots of the spinal nerves supplying the muscle; 3) sympathetic component to the interossei of the hind foot by cutting the dorsal and ventral roots of the spinal nerves supplying them distal to the dorsal root ganglia, which were removed, in such a manner that the gray rami were left intact. After sufficient degeneration time was allowed in each series, the animals were killed and pieces of muscle were drawn through the spinal cord of the cat and stained according to the pyridine-silver technique. These experiments have been carefully controlled. Unmyelinated fibers arising from all three components have been observed in the muscle. Observations on the endings of these fibers on muscle are not as yet complete. Unmyelinated fibers arising from both dorsal root and from the sympathetic cord were observed in relation to the blood vessels in the muscle. When the ventral root component alone was present, no fibers were observed on blood vessels. This shows absence of sympathetic fibers to these blood vessels from the aortic plexus.

29. Growth in the motor neurons of the cranial nerves of the albino rat. Ira D. Hogg, Department of Anatomy, University of Kansas, (introduced by Davenport Hooker), Department of Anatomy, University of Pittsburgh.

Comparisons were made as to diameter of the perikarya, direction of dendrites, tracts with which synapsis occurs, and size and shape of the Nissl bodies of the motor neurons of the cranial nerves of the newborn and adult albino rat.

Perikarya are greatest in diameter along the axis of their largest dendrites. The relative diameters of the perikarya of certain nuclei (abducens, dorsal vagus) or of groups within a nucleus (hypoglossal) change between birth and maturity.

In the newborn rat the precocious dendrites of the abducens nucleus extend toward the vestibular nuclei, those of the dorsal group of the hypoglossal nerve extend toward the nucleus of the fasciculus solitarius and those of the lateral group of the same extend toward the nucleus of the tractus spinalis V, those of the dorsal vagus nucleus extend toward the nucleus of the fasciculus solitarius. Nissl bodies increase in mass between birth and maturity.

30. The effect of injury to the spinal cord of rats in prenatal stages. Davenport Hooker, University of Pittsburgh School of Medicine, and J. S. Nicholas, Osborn Zoological Laboratory, Yale University.

The experiments of the senior author have shown that injury to the cord in young rats may be followed by later adjustments of the nervous reactions so that the loss of function caused by the injury is not nearly so great as was initially expected.

Gerard and Koppanyi have reported regeneration of cords in rats which were operated upon during fetal life. Their work is subject to criticism, since there was no histological control and also since positive identification of the operated animals was not secured.

Our experiments have been performed upon rat fetuses from twelve to nineteen days of age, the animals being either removed at various intervals or permitted to remain in utero until birth. The animals were positively identified by cutting off the fore limb according to the method developed by the junior author. Histological studies were made upon each case after the extent and range of movements had been tested.

Fourteen cases in which either partial or complete destruction by cautery of a portion of the cord had been secured fail to show the slightest signs of regenerative reconstitution of the nervous system. Slight tendencies toward spasticity and slight variations from definite types of response were observed, but the reactions are surprisingly normal.

31. Unilateral extirpation of the primordial germ cells in Amblystoma; its effect upon the development of the gonad. R. R. HUMPHREY, Department of Anatomy, University of Buffalo.

The germ cells of Amblystoma, because of their superficial position in early embryos (stages 28 to 36) may easily be removed by operative methods. Over sixty animals have been autopsied and studied after periods of from 6 to 233 days following the operation.

Complete unilateral extirpation of the primordial germ cells results in the absence of a typical gonad on the operated side. Genital ridges sometimes develop, but no secondary germ cells have been found to differentiate from their covering epithelium, nor from the peritoneum or mesenchyme at any other point. Fat-bodies of variable size (always subnormal) are usually present in the cephalic half of the genital territory, either alone or associated with the sterile genital ridges mentioned above.

Extirpation of the primordial germ cells in Amblystoma jeffersonianum was frequently incomplete, owing to the fact that the germ cells of this species extend caudad farther than in Amblystoma maculatum. From groups of germ cells not removed at operation, an ovarian or testicular fragment is developed at the extreme caudal limit of the genital territory. The germ cells in this correspond in development to those of the normal gonad on the unoperated side.

These results indicate that the primordial germ cells of Amblystoma are essential to the normal development of the gonad.

32. A statistical study of the relationships between body build and various physiological measurements of male university students. C. M. JACKSON, Institute of Anatomy, University of Minnesota.

Measurements were taken in 1924 on 1633 entrants, including 267 of purely Scandinavian descent and 107 German. The age averages 20.08 years (range, 16 to 39); average height, 68.7 inches; average weight (nude), 141.4 pounds; average weight: height^2 index, $29.962 \pm .054$ (range, 21 to 53). The frequency distribution of the index yields a unimodal curve, with no indication of distinct types of body build.

The student group appears distinctly taller, but not heavier, than the corresponding general population (shown by Minnesota draft records).

The German group averages slightly but significantly higher than the Scandinavian in weight, weight: height^2 index, chest circumference, and vital capacity, with insignificant differences in stature, sitting height, chest expansion, blood pressure, pulse rate, and Schneider's cardiovascular rating.

The average weight increases slightly with age; but the height remains practically constant (a remarkable finding, indicating that the students are physically precocious). The correlation (r) between weight and height is $+ .500 \pm .012$. The weight: height^2 index is definitely correlated with (quiet) chest circumfer-

ence ($+.672 \pm .009$), age ($+.298 \pm .015$), sitting height ($+.135 \pm .017$), vital capacity ($+.188 \pm .016$), cardiovascular rating ($+.129 \pm .017$), and pulse rate ($-.095 \pm .017$). The index shows no significant correlation with systolic blood pressure or chest expansion.

There is only a moderate degree of correlation ($+.351 \pm .015$) between chest expansion and vital capacity. This is contrary to Hutchinson's doctrine, which physicians have generally followed.

33. The comparative histology of the lymph nodes of the rabbit. H. E. Jordan and J. B. Looper, Laboratory of Histology and Embryology, University of Virginia.

This investigation is based upon the subcutaneous, cervicosubmaxillary, and abdominal groups of lymph nodes of four rabbits, including three adults and one about a month of age. Only one of the adults had subcutaneous nodes, an axillary and inguinal pair. The other two adults showed nodules of dense fibrous tissue in comparable locations. A closely graded series of stages of lymph nodes can be arranged from young nodes in which the cortical area dominates, through intermediate regressive stages characterized by a progressively expanding medulla, to such as show unmistakable signs of degeneration and fibrosis. The evidence supports the claim of Gulland ('94) that lymph nodes are evanescent structures. The nodes may be classified under the types I and II of Job ('22) described for the rat. Many of these nodes are closely comparable to the submaxillary lymph node previously described, in which there occurred extensive transformation of lymphocytes of the medullary cords into erythrocytes. The condition is more common in the cervicosubmaxillary and subcutaneous groups. It is apparently correlated with atrophy and disjunction of the lymphatics. The medullary sinuses are generally empty except for widely scattered reticulum cells, and occasional lymphocytes, granulocytes, and erythrocytes. The red blood corpuscles formed in the cords may enter the axial venules or be ingested in situ by monocytes of reticulum cell origin.

34. The course of blood through the fetal heart of mammals. Howard B. Kellogg (introduced by L. B. Arey), Northwestern University Medical School.

The first exact experimentation on the course of the blood through the fetal mammalian heart was done by Pohlman ('07), who substantiated Harvey's teaching that the two caval streams mix equally in the right atrium and so distribute blood of the same quality to all parts of the body. Nevertheless, the Sabatier explanation of the separation of venous and arterial blood by the eustachian valve and foramen ovale is still widely accepted. The present study has repeated Pohlman's experiments on a larger scale and has extended them by the use of more exact methods. The general conclusion is in complete agreement with his thesis.

Direct ocular observation of living fetal hearts after the injections of colored suspensions into the superior and inferior venae cavae show that the suspensions reach the two ventricles simultaneously and color them equally. Quantitative determinations of blood from the two ventricles after similar injections prove that equal amounts of the suspension reach the two sides of the heart. Further analysis of blood from the two ventricles, by the Van Slyke method, while the

placental circulation remains intact, show that the oxygen and carbon-dioxide content is the same on both sides of the heart.

A continuation of the study into correlated problems of the fetal circulation is bringing to light many interesting and significant relations.

35. The distribution of unmyelinated nerve fibers to the arteries of the extremities. Alver H. Kerper (introduced by Albert Kuntz), Saint Louis University School of Medicine.

Segments of vessels of the proximal, middle, and distal portions of the extremities, obtained from experimental animals killed at intervals varying from five weeks to three months following unilateral extirpation of the lumbar sympathetic trunk and the inferior cervical sympathetic ganglion, with or without ligation and section of the femoral and brachial arteries on the opposite side, were prepared by the pyridin-silver method, sectioned, and studied with reference to the relative number of unmyelinated fibers present on the operated and non-operated sides.

Preparations of the arteries that had been ligated and cut show an abundant nerve supply, but reduced as compared with the normal control vessels. A still greater reduction is apparent in the vessels of the sympathectomized limbs. This reduction is less marked in the hind than in the fore limb. The adventitia of arteries partially denervated in the above manner exhibits nerve fibers in relatively large bundles, some of which appear to terminate there, while others turn abruptly into the media and ramify within the muscularis. Collaterals from apparently long fibers also enter the media at irregular intervals.

36. On the distribution of unmyelinated nerve fibers in muscles of the extremities following degeneration of the somatic nerves. Albert Kuntz, Saint Louis University School of Medicine.

Dogs were subjected to an operative procedure in which both roots of the spinal nerves supplying either the hind or fore limb were cut unilaterally just distal to the spinal ganglia. The animals were allowed to live three to six weeks after this operation. Pieces of muscle tissue both from extensor and flexor muscles of the affected limbs were prepared by the pyridin-silver method and sectioned. Some of the pieces were selected to include the point at which a muscular ramus of the nerve enters the muscle.

Sections of these muscular rami exhibit numerous intact unmyelinated fibers, but the myelinated fibers show an advanced stage of degeneration. Neither myelinated fibers nor their motor end-plates can be found within the muscle. The majority of the unmyelinated nerve fibers, as they leave the larger rami, lie along the smaller blood vessels, including the capillaries. Some of these fibers apparently terminate in the walls of the blood vessels, others deviate from the blood vessels and terminate in relation to muscle fibers.

In view of the time intervals during which the animals were allowed to live following section of the spinal nerve roots, and the apparent degeneration of the myelinated fibers in the muscular rami of these nerves, the conclusion is drawn that the unmyelinated fibers which remain intact in the muscles are of sympathetic origin. These findings in general corroborate the experimental anatomical findings of Boeke ('13), Boeke and Dusser de Barenne ('19), and Agduhr ('19).

37. A comparison of the age with the number of somites in the white rat. F. L. LANDACRE, Ohio State University and University of California.

A study has been made of the number of somites in rat embryos from the Berkeley colony, the offspring of tested males and females not previously bred. The ages of the embryos were accurately determined from the time of coitus. Two hundred and twenty-two embryos, the offspring of thirty-seven females were examined. Accurate counts of the somites in 173 embryos, or 78 per cent of the total, were made. The average of all standard deviations of the number of somites is 2. The age of embryos ranges from ten days twelve hours to eleven days twenty hours. Tables will be presented giving details.

38. The histological development of cerebral motor areas in young kittens correlated with their physiological reaction to electrical stimulation. ORTHELLO R. LANGWORTHY, Department of Anatomy, Johns Hopkins University.

A physiological study of the development of motor areas in the cerebral cortex of new-born and young kittens has previously been reported (Weed and Langworthy, 1926). A large series of adult cats were subjected to similar stigmatic exploration as controls. In newborn kittens an area may be demarcated which, upon stimulation, produces movements of the contralateral fore leg. No responses from the hind-leg area could be obtained until the kittens were sixteen days old. The facial area did not respond to electrical stimulation until twenty-one days of age.

Upon histological study of the cerebral cortices of adult cats it was found that the motor area had been accurately delimited under the conditions of the physiological studies. Moreover, the motor areas presiding over different portions of the body musculature could be distinguished histologically by variations in the development of the different layers and the arrangement, size, and internal structure of the giant pyramidal cells.

From the developmental standpoint, the area presiding over fore-leg movements was more mature at birth than the center for the hind-leg and facial musculature. The progressive maturation of these motor areas was followed. The pyramidal tracts of kittens show no myelinization until nine or ten days after birth.

39. Correlations of the weights and lengths of the body, organs, and systems of the turkey hen. HOMER B. LATIMER, Department of Anatomy, University of Kansas.

The correlations between the net body weight and the weights of the organs range from a high positive correlation of 0.87 for the eyeballs to a negative correlation of 0.60 for the thymus. The six parts with the highest correlations form 83 per cent of the total weight of the turkey. The heart forms but 0.5 per cent of the total weight, yet it has the second highest correlation.

The correlations of the heart with the kidneys, liver, spleen, and digestive tract are all good position correlations.

The weights of the ovary and oviduct have a very high positive correlation and the correlation between the ovary and the thymus is a significant negative correlation.

The weights of the three leg bones form higher correlations with both the skeletal weight and the body length than do the wing bones.

The skeletal weight is more closely correlated with the lengths of the wing bones and the weights of the leg bones. The correlations between the skeletal weight and bone weight for all of the long bones are higher than between the skeletal weight and the bone length. The higher correlations in the lengths of the individual bones are between bones in the same extremity.

The anthropometric indices show that the wing and the individual bones of the wing are relatively longer in the turkey than in the chicken.

40. The postnatal growth of the cat. Homer B. Latimer, University of Kansas, and John M. Aikman, University of Nebraska.

The weights of the body, head, trunk, fore limbs, and hind limbs have been determined for 170 cat embryos of unknown age, but ranging in weight from 2.6 grams to newborn. Several embryos yet to be measured are smaller than any so far studied.

The following measurements have been recorded; the lengths of the body, both nose-anus and the crown-rump, the tail length, the length and breadth of the head, the dorsoventral and the transverse diameters of the thorax, and the circumference of the neck and the thorax.

The lengths of each division of the fore limbs and the hind limbs have been recorded for the right and left appendages.

The volumes of the body, head, trunk, fore limbs, and hind limbs have been determined for all except the volumes of the appendages in the smaller embryos.

Graphs and statistical data will be presented at the meeting.

41. Observations on the fovea centralis of two human and seven monkey pairs of eyes. P. Lineback, Emory University.

Nine pairs of monkey eyes, chiefly Macacus rhesus, were secured in very favorable condition from the London Zoo through the good office of Dr. John Beaty. These with two pairs of fairly good human eyes were studied grossly under the binocular 'scope, and the maculae were then sectioned serially.

Proceeding under impetus of discussions of cell nature and numbers by Collins, Parsons, Woolard, and Cajal, the foveal region in the two eyes of the same individual was selected for comparative study. The nature of the fovea came to special attention. In all the specimens, both man and monkey types, there appears a well-defined flat area directly in the center of the fovea. Woolard has given an excellent photomicrograph of this, but placed no special emphasis upon it. Simply for convenience, it is here indicated by the term 'foveal floor.' In this floor the retinal organization is reduced to its simplest form. One point of difference between the two floors is the simpler nature of the right one; in this present series there were found fewer cells in it than in the left one. In this series also the right fovea was closer to its optic nerve than the left one to its nerve.

42. On the nature of the capsule of the fat-corpuscle. Marie Dees Mattingly (introduced by Irving Hardesty), Department of Anatomy, Tulane University.

The capsule of the fat-corpuscle consists of, *a*) a very delicate membrane of almost homogeneous texture, possibly a fine felt-work of white fibrous connective tissue, within or upon which is embedded, *b*) delicate bundles of collagenous

fibrillae. These bundles of fibrillae vary in their arrangement depending upon the size of the fat-corpuscle and the amount of stress to which the capsule is subjected.

In small corpuscles the bundles are not differentiated from the delicate membrane or background that supports them. As progressively larger corpuscles are studied, the fibrillae are observed in reticular formation. The reticulum is at first incomplete and widely spaced; but with increased stress (increased fat content) it becomes more pronounced, forming a close-meshed reticular pattern of heavier bundles. The reticulum then covers most of the surfaces of the now polyhedral corpuscles and grades into larger bundles of compact fibrillae situated like fence posts in the angles formed by adjacent sides of the polyhedron. As the capsules become subjected to still greater stress, the reticulum appears drawn out, forming parallel, rib-like bundles that arise from the 'posts,' common not only to adjacent sides of the same corpuscle, but also to adjacent sides of adjoining corpuscles. These ribs extend across the surface of the corpuscle, simulating rails of a fence, which, however, frequently split and rejoin, join an adjacent rib, or become lost in the substance of the membrane.

43. The effect of castration on the size of the parathyroid glands and susceptibility to parathyroidectomy in the albino rat. MILTON D. OVERHOLSER (introduced by Margaret M. Hoskins), Department of Anatomy, New York University Dental School.

Relative sizes of parathyroids were obtained by sectioning them at 10 μ, drawing every fifth section by projection apparatus and obtaining total area of reconstruction with a planimeter. Index of reconstruction was obtained by dividing area by body weight. Castration was done generally at twenty days, a few at thirty and forty days. Average body weight, area reconstruction, and index reconstruction are given, respectively, in three age series.

Series 1, 60 days. Castrated—44 animals; 111.2, 209.9, 1.941. Controls—39 animals; 110.9; 211.6, 1.962.

Series 2, 75 days. Castrated—17 animals; 131.4, 229.9, 1.937. Controls—15 animals; 135.5, 278.4, 2.192.

Series 3, 90 days. Castrated—16 animals; 149.4, 235.3, 1.637. Controls—13 animals; 138.1, 257.6, 2.127.

Series 1 shows no difference in parathyroid size between castrated and controls. Standard of deviation and probable error in series 2 show a probable significant difference in area reconstruction; in series 3 the difference appears in both area and index, and also between index at 60 and 90 days in castrated.

In susceptibility study two series were obtained: 1) 60 days; castrated—21 animals; controls—21 animals. 2) 90 days; castrated—17 animals; controls—16 animals. No difference in susceptibility appears between castrated and controls at 60 days. A possible lowered susceptibility appears at 90 days in both castrated and controls. These series should be extended before drawing definite conclusions.

44. Superior olivary nucleus and its fiber connections. JAMES W. PAPEZ, Cornell University, Ithaca.

In this group of experiments on cats small lesions were placed in the region of the superior olive from the ventral side through a small drill hole in the base

of the cranium medial to the middle of the tympanic bulla. The lesions were made with a small pointed hook which pierced the trapezoid body and was then rotated so as to damage the two segments of the superior olive.

The Marchi method shows a stream of degenerated fibers passing dorsally through the reticular formation to reach the internal genu of the facial nerve Closely beneath the genu they turn medially, cross the midline over the dorsal border of the medial longitudinal bundle, and pass laterally beneath the facial genu of the opposite side. Then they cross the outgoing limb of the facial nerve, pass ventral to the medial vestibular nucleus, and reach the dorsal border of the descending root of the trigeminus nerve. Here they join the root of the vestibular nerve and with it curve ventrally over the surface of the descending root of the trigeminus. Their further course is not known, but they appear to form a small crossed outgoing nerve root associated with the acoustic nerves. Lesions between the genua of the facial nerves produced a bilateral degeneration of these nerve fibers.

45. An interpretation of the structural relations of the internal ear on the basis of sound cancellation. A. G. POHLMAN, Saint Louis University.

Practically all investigations on the morphology of the internal ear have been directed toward the problem of pitch analysis. There appears, however, to be no theory of pitch analysis which fits the facts established by quantitative methods of determining minimum audition. The problem of the acoustic insulation was brought to the attention of the association some two years ago. The writer was aware at the time that the term 'insulation' was poorly chosen because sound passes through all media. No less remarkable than the function of pitch analysis is the phenomenal sensitivity of the end organ and its ability to maintain this sensitivity under conditions of auditory insult. The small size of the entire apparatus when compared with the wave lengths of audible sounds makes a consideration of phase relations quite unnecessary. The only remaining alternative is that of sound cancellation which may operate automatically for all frequencies. Experimental evidence seems to indicate that some deafened individuals may possess a relatively normal end organ, but that the essential physical conditions under which this end organ operates are being violated. The assumption of an automatic intensity control is therefore intimately related to the physics of sound transmission in normal and abnormal cases.

46. A quantitative study of the 'law of developmental direction' in the human fetus. RICHARD E. SCAMMON, Department of Anatomy, University of Minnesota.

Much of the evidence offered for the 'law of developmental direction' is qualitative in character. However, with the many quantitative data on human fetal growth now available, the validity of this 'law' may be tested by analytic methods.

Two analytic tests have been used in this study. The first is the 'length interval ratio,' which is the relation of the amount of growth of a part during a given interval of increase in body length to the amount of growth accomplished by the same part in the next succeeding and equal interval of increase in body length. The second test is the 'relative instantaneous velocity,' determined by dividing the velocity of growth (with respect to time) of any part or dimension, at a given time in the fetal period, by its magnitude at this time.

These tests have been applied to the growths of the major external dimensions of the body, the external dimensions of the extremities, the spinal column, certain limb bones, the respiratory system, the gastro-intestinal tract, the masses of the major divisions of the body, and the central nervous system. In almost all instances they give definite evidence of the quantitative action of the 'law of developmental direction.' Exceptions to the 'law' are found in the growth of certain trunk girths, the sacrococcygeal spine, and certain brain parts.

47. Plasma cells in the mucous membrane of the upper respiratory passages. J. Parsons Schaeffer, Daniel Baugh Institute of Anatomy, Jefferson Medical College.

Plasma cells appear to occur normally in the mucous membrane of the nasal fossae and the paranasal sinuses. They occur in certain inflammatory conditions in greatly increased numbers. Since it is difficult to secure perfectly normal nasal and sinus mucous membranes, e.g., those which have not in some measure reacted to irritants, the problem of the normal incidence of plasma cells in this location is hard to establish. The cells are of the more usual spheroidal type and appear to be more numerous in the young subject. Lymphocytes are also normal and numerous in the mucous membranes of the nasal fossae and the sinuses. However, the plasma cells are readily identified, being larger than lymphocytes, the nucleus being eccentrically placed and the protoplasm not infrequently vacuolated. Basophil granules are found in the protoplasm. It is believed that these wandering cells are phagocytic in the upper air passages.

48. A quantitative analysis of the prenatal growth changes of the human stomach wall. Gordon H. Scott, Department of Anatomy, Loyola University School of Medicine, Chicago.

An analysis of strips of the stomach wall, extending from cardia to pylorus, has been made in seventy-three specimens ranging from 0.8 to 54.5 cm. body length. The relative amounts of the epithelial, connective-tissue, and muscle elements concerned in the architecture of the gastric wall have been determined. In the specimens of 25 to 54.5 cm. body length the weights of the parts have been determined.

When a section of a strip of the stomach, extending from the cardia to the pylorus, is analyzed, and the various laminae determined in terms of the relative amount seen in cross-section, there is slight change shown in the quantitative relations of the major parts from the fifth fetal month to the time of birth. However, if a more detailed analysis of the stomach wall is made in the fundic and pyloric regions changes in quantitative relations occur with an increase in prenatal age. The connective tissues were the most variable in relative amount of any of the parts determined. The quantitative relations of the major divisions of the gastric wall at birth are as follows: mucosa, 31.61 per cent, connective tissue and submucosa, 31.29 per cent, tunica muscularis, 37.10 per cent.

49. Precocious sexual maturity in the mouse following pituitary transplants. Philip E. Smith and Earl Theron Engle, Stanford University.

Sexual maturity is induced in female mice seventeen to twenty days old by three daily pituitary homeoplastic implants. This is a greater relative acceleration than that which occurs in the rat following similar treatment. The ovarian

uterine and vaginal changes characteristic of oestrus occur. Pituitary heterotransplants from the rat and guinea-pig cause these changes within the same time. Anterior-lobe transplants from the rabbit cause precocious oestrus with only two daily transplants. If one-half the pituitary is transplanted, the usual three daily treatments are required, suggesting a quantitative factor. That complete oestrus development is caused is evidenced by one litter in which mating occurred on the twentieth day of life. Homeo- and heterotransplants in mice of eighteen to twenty days of age cause some increase in the weight of the testes and a marked increase in the remainder of the genital system, the latter exceeding by ten times that of the litter-mate controls.

50. The placental transmission of adrenalin, insulin, and pituitrin. Franklin F. Snyder and F. Meredith Hoskins, University of Rochester.

Numerous investigations have shown the presence of very active substances in the embryonic adrenal, pancreas, and hypophysis. In the present experiments foetuses in utero were injected intramuscularly and intraperitoneally with large doses of adrenalin, insulin, and pituitrin, and the mother was observed for any evidence of the effects characteristic of these substances. When adrenalin was injected in rabbit embryos near term, there was no rise in the material blood pressure such as followed direct injection of the mother. Similarly, when rabbit embryos were injected with doses of insulin which would produce convulsions when given to the mother, hypoglycemia was not found to occur in the maternal organism. When pituitrin was injected in guinea-pig embryos no marked muscular contractions were noted in the mother, such as occurred after direct injection of the maternal organism. The animals were observed for several hours after the injection of adrenalin and pituitrin. After the injection of insulin, blood samples were taken for nine hours. Despite the large doses of adrenalin, insulin, or pituitrin, the foetuses remained alive throughout the experiment.

51. Surface anatomy and the superficial muscles in action. Robert W. Southerland, Edgar Allen, and Harry H. Charlton, Department of Anatomy, University of Missouri.

The subject, a medical student, had for years been perfecting muscle development and control by weight lifting, acrobatics, and other athletics. His comparatively slight build and bunchy but not massive muscles unobscured by subcutaneous fat made him an ideal subject for the demonstration of surface anatomy, especially the changes visible in the external muscles during activity.

Such demonstrations before the classes in dissection proved so stimulating that motion pictures were taken. Augmented by lantern slides of still poses and muscle plates from anatomical atlases, this film has proved valuable equipment for the teaching of superficial anatomy to both medical and art students.

52. Studies of hyperthyroidism. VI. The response of newly regenerated areas to thyroid administration in amphibian larvae. C. C. Speidel, University of Virginia Medical School.

If a portion of the tail of a tadpole is amputated and regeneration for several days allowed to take place, the tail then consists of two distinct regions, different in age and in degree of differentiation, an older more proximal part and a newer more distal part. These react to thyroid administration differently. The melano-

phores of the old tail become contracted, those of the new remain expanded, a sharp line of demarcation between them indicating the region of the cut.

The fin expansion of the old tail undergoes relatively early resorption, that of the newly regenerated part persists for some time and is finally resorbed at a later period. Owing to this difference in resorption time, conspicuous fin expansions limited to the terminal portion of the tail only, may be produced experimentally. A similar effect may be obtained if the animal is subjected to partial tail amputation after several days of thyroid treatment.

Extirpation of V-shaped sections from the dorsal and ventral fin expansions of large bullfrog tadpoles, followed by regeneration and thyroid treatment, leads to somewhat different results. In this experiment the new areas undergo reduction before the older adjacent tissues of the tail. As this result is difficult to reconcile with the terminal fin expansion observation noted above, a further experimental analysis is being attempted.

This study includes also observations upon the effect of thyroid treatment upon regenerating limbs and gills.

53. Extra toes in the guinea-pig—an atavistic condition and its genetic significance. CHARLES R. STOCKARD, Cornell Medical School, New York City.

Modern races of guinea-pigs have four toes on the front foot and three toes on the hind foot. Like all mammals, these have probably evolved from ancestors with five digits on each foot. Among guinea-pigs an extra toe very rarely develops on the hind foot. In each of eight different family stocks observed for more than ten years extra toes have occurred on the hind feet of a few individuals.

The additional toe represents the ancestral little toe and varies in development from a structurally perfect digit through all degrees of imperfection to an attenuated fiber tipped with a malformed toe nail; such a remnant is often lost at birth or soon after. In breeding for the extra-toed condition, the percentage of expressed inheritance varies directly with the perfection of development of the parental extra toes. Finally, mating animals with only perfectly developed extra toes 100 per cent of the offspring show extra toes in various degrees of perfection. Within this carefully selected group a five-digit front foot has developed in a single case. We thus obtain through particular selection a return to the ancestral five-toed condition in the front foot and to the four-toed stage on the hind foot. The germinal basis for five digits is still present in these animals, although unexpressed in racial evolution for long generations.

54. Ventral skin grafts in Diemyctylus replacing skin containing lateral-line sense organs. L. S. STONE, Yale University, School of Medicine.

These transplants were made upon adult Diemyctyli viridescens. The site of the graft on the side of the body was first prepared by removing skin containing lateral-line sense organs, leaving, however, the underlying lateral-line nerve trunk intact. Into this wound was transplanted belly skin containing no lateral-line sense organs. These operations are part of a series of experiments devised to test the so-called ability of nerves to stimulate indifferent skin to form sense organs. This ability has been suggested by some investigators who have cut lateral-line and gustatory nerves and followed the regeneration of the nerves and their related sense organs. Microscopic examination of these skin grafts from 16 to

266 days after operation never revealed any lateral-line sense organs in them. In some specimens killed over 250 days after operation the skin grafts retained their ventral skin pigment pattern. Many transplants eventually became darkly pigmented like the surrounding lateral skin of the host. In many of these a fine film of pigment wanders into the region of the graft from the surrounding host skin within two months' time. In some this takes place much later. A large part of the original vascular pattern of the graft is often found in circulation within a few days (three to four) after operation.

55. Development of the deep cervical drainage in the rabbit. LEON H. STRONG (introduced by Burton D. Myers), Indiana University School of Medicine.

Coincident with the degeneration of the postcardinal veins there develops, dorsal to the capituli costae, a capillary venous plexus extending from the occiput to the lumbar region. This dorsal costal plexus persists between the second and fourth intercostal spaces as the posterior vertebral vein. Anterior to the second intercostal space the plexus differentiates into the deep cervical, transverse cervical, and transverse scapular veins.

Within the thorax a plexus has formed between the intersegmental veins, the upper portion of which persists as the superior intercostal vein.

These two plexuses, without and within the thorax, communicate around the heads of the ribs and with the intersegmental veins. Later, all the venous paths from the outside of the thorax to the inside degenerate except the second intercostal vein which receives the superior intercostal and all the derivatives of the dorsal costal plexus, and becomes the costocervical trunk.

Variations occur in which intercostal veins other than the second may persist as the costocervical. Significant of this condition, it is suggested that in man, with relatively small neck musculature, the costocervical vein has been lost by a shifting of the extrathoracic drainage from a discharge point below the clavicle to one above it.

Costocervical development in the rabbit accords with that in the pig (Reagan, '19). Unpublished studies by Andrews, of these vessels in the adult rabbit, are confirmed.

56 a. An unidentified dark pigment found in the cortex of a sheep kidney. R. M. STRONG, Department of Anatomy, Loyola University School of Medicine, Chicago.

A portion of a sheep-kidney specimen which has a black cortex has come into my possession. Sections of this material show swollen basement membranes about the convoluted tubules. These membranes have a diffuse unidentified pigment which gives them a dark gray color under the microscope. The epithelium is necrotic.

56 b. Observations on the skeleton of the progeny of parathyroidectomized albino rats. R. M. STRONG, Department of Anatomy, Loyola University School of Medicine, Chicago.

Female albino rats which have had their parathyroid glands entirely removed have been mated with normal males and with males that have had the same operation. No difference has thus far been observed in the skeletons of their

progeny at birth as compared with the offspring of unoperated normal rats of the same age. During the period of lactation, however, changes occur which will be discussed.

57. Rate of cell division in stratified squamous epithelium. Joseph M. Thuringer, School of Medicine, University of Oklahoma.

The rapid progress of mitosis was thought to be a factor in the failure to observe an adequate number of mitotic figures that would account sufficiently for the loss of cells by desquamation. With this in mind, fresh human material was obtained (normal prepuce of a three-year-old boy). Part of it was fixed in Zenker's fluid immediately and at intervals of five and fifteen minutes after removal. The celloidin-paraffin serial sections were 10 μ in thickness. First series, 188,200 cells counted with a total of 135 mitotic figures, ratio 1: 1384. Second series, 419,825 cells counted with 88 mitotic figures, ratio 1: 5120. Out of 354,250 cells in the third series only 30 mitotic figures were present, giving a ratio of 1: 11,807. The above figures apparently indicate that most mitoses, if inaugurated before removal of the tissue, go to completion of the cycle unless tissue asphyxiation occurs in the meantime. The evidence presented previously that cell proliferation in the stratum spinosum greatly exceeds that taking place in the stratum cylindricum is strongly supported. Out of a total of 962,275 cells counted, only 253 mitotic figures were encountered, and of these only twenty-five were found in the stratum cylindricum. Furthermore, all mitotic figures in the stratum cylindricum were parallel to the basement membrane.

58. Radiographic study of physical growth in children. T. Wingate Todd, Western Reserve University.

We have studied 568 children from five to sixteen years; measured, weighed, and tested muscular strength; made radiograms of left hand and wrist, elbow, shoulder, foot and ankle, knee, and hip.

Weight may vary 3 to 4 pounds a day; dimensions are very constant in relation to standing height; muscular strength is profoundly affected by the interest and the state of health of the child. Average dimensions in samples of fifteen to twenty-five are fairly reliable for the social class from which the children are drawn.

Our previous investigations show that—

i. There is no relationship between commencement of ossification of an epiphysis and its final union with the shaft.

ii. The human wrist and forearm have undergone considerable modification in differentiation and are not so dependable as other limb epiphyses for estimations of age.

iii. The time of commencing 'precipitation' of bone in the wrist cartilages is erratic.

iv. The terminal stages in ossification and union of epiphyses are most closely time-linked.

v. Dimensions of epiphyses on radiograms are not comparable with dimensions of the actual epiphyses, since bone only, and not cartilage, is shown on the radiogram.

Taking the knee as an example, we can trace definite age relationships in epiphysial ossification.

59. The follicular pattern of the thyroid gland of Amblystoma maculatum. E. Uhlenhuth and Hilda Karns, Marine Biological Laboratory and the University of Maryland Medical School.

Thyroids of Amblystoma maculatum, from an early larval stage until sex maturity, were macerated and dissected into individual follicles. Each follicle is a completely closed vesicle. At first the follicles are spherical, later on they become very irregular in shape and may be composed of two or several smaller follicles. The average number of follicles is approximately forty per thyroid. Although the individual variability of the follicular number is considerable, it does not show definitely a relation to metamorphosis and is independent of development and growth of the thyroid. The number of follicles in any particular thyroid is determined at an early stage. Growth of the whole thyroid takes place not by division of large follicles into smaller ones or by budding, but by increase in the size of the primary follicles. The mode of the growth of the individual follicle is not quite certain. Perhaps small primary follicles develop continuously out of reserve cell-masses and fuse with the follicles already present, thereby causing growth of these follicles.

Distinct differences in the number of follicles exist between offsprings of different females. Larvae of the same brood reared under different conditions show likewise differences in the number of follicles.

60. A quantitative study of the growth of the arteries of the human fetus. Charles H. Watkins (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.

The growth in weight in the fetal period of the various segments of the arterial system which supply both the body and the placenta does not follow the general course characteristic of the weight of the body as a whole and of most of the organs and parts, which have been quantitatively studied to the present time, but is characterized by a relatively long period of slow growth up to 30 cm. CH., and a more rapid growth from then until birth. The growth in weight of the segments of the arterial system which supply the body only appears to be directly proportional to the growth in weight of the part supplied by each segment. The growth in weight of the various segments of the arterial system which supply both the body and the placenta is directly proportional to the growth in weight of the heart. The relative amount of growth (as determined by the percentage increment) and the relative instantaneous velocities of the various segments of the arterial system are greatest in the fifth fetal month. There is also indirect evidence indicating a relatively rapid growth in length of the thoracic and abdominal portions of the aorta during the fifth and sixth fetal months.

61. Notes on the anatomy of human embryos with 17 to 23 pairs of somites. I. Chuan Wen (introduced by G. W. Bartelmez), University of Chicago.

A 17-somite embryo (H951 Emb. Coll. Dept. Anat.) was studied in detail and compared with embryos of 22 (H1093) and 23 somites (H984). The 17-somite specimen has the anterior neuropore in the process of closure, the telencephalon is recognizable, there are two mesencephalic segments and seven typical rhombomeres. The fourth ventricle has appeared. The Vth neural crest is in continuity

with rhombomeres 1 and 2 and is related peripherally to a placode which seems to be contributing cells to it. The IXth neural crest in both 17- and 22-somite embryos resembles that described by Giglio-Tos in a 15-somite embryo, but it cannot be traced out to the placode in the first of these. The vagal crest and placode can also be recognized. The 'discus incertus' is present bilaterally in the 17-somite stage, but only on the left side of the 22-somite specimen. The 'internal gill rudiment,' present in visceral pouches I and II of the youngest embryo, appears only in the second pouches of the 23-somite stage. The dorsal aortae have begun to fuse from the level of the Xth to XIVth somites in the 17-somite embryo. Here nephrostomes can be recognized in the region of somites VI to IX, and the pronephros forms a ridge on the dorsal surface at the Xth to XIVth-somite levels. All three embryos show mesenchyme formation from the prechordal plate.

62. The innervation of the taste buds on the vallate and foliate papillae of the rat. Beatrice Whiteside, Detroit College of Medicine and Surgery.

The fact that taste buds degenerate after section of their nerves suggested a method for determining the innervation of the taste buds on vallate and foliate papillae of the rat.

After section of one glossopharyngeal nerve, the taste buds on the single median vallate papillae appeared almost normal in number. Cutting of both glossopharyngeal nerves caused all taste buds on vallate papilla to degenerate. This indicates that the chiasma of the glossopharyngeal nerves differs from that described by Vastarini-Cresi.

Section of one glossopharyngeal nerve caused the disappearance of the majority of the taste buds on foliate of that side. A few buds remained, chiefly on anterior two folds. Section of one lingual nerve (containing chorda tympani fibers) caused degeneration of a few taste buds. Cutting of glossopharyngeal and lingual nerves of the same side effected degeneration of all taste buds on foliate of that side.

To cause disappearance of all taste buds on the vallate and the two foliate papillae it was necessary to cut both glossopharyngeal and both lingual nerves.

These results differ somewhat from the work on the rabbit. The conditions in the rate agree fairly closely, however, with the gross distribution of the glossopharyngeal and lingual nerves of the human.

63. Innervation of the tooth pulp. William F. Windle, Department of Anatomy, Northwestern University Medical School.

The pulp was destroyed in teeth of the left jaws of five cats and one dog by means of a dental broach. Time was allowed for chromatolysis to develop, and the gasserian ganglia were removed and prepared by the toluidin-blue method, the right ganglia serving as controls for the left. Few large cells show chromatolysis, while many small ones, of the types that are known to give rise to unmyelinated nerve fibers in the spinal nerves, have reacted.

Small branches of the dental plexus as well as the contents of the pulp cavities were stained by the osmic-acid and the pyridine-silver methods. A segregation of small myelinated and unmyelinated fibers was observed in some of the small nerves. However, the pulp nerves themselves appear to contain no significant number of unmyelinated fibers. They are composed almost exclusively of the small myelinated type.

The tooth pulp seems to be sensitive to pain only, and in the case under consideration that sensation is apparently transmitted largely by small myelinated nerve fibers which arise from small cells in the gasserian ganglion.

64. On the placentation of the sloth (Bradypus griseus). GEORGE B. WISLOCKI, Department of Anatomy, Johns Hopkins University.

In gross form and changes in shape which the placenta undergoes during gestation it differs markedly from other mammals. The placenta is at first diffuse, in the form of irregularly distributed lobules. As the uterine cavity and the placenta enlarge, certain of the lobules in the fundic region grow in size, while the remainder of the lobules undergo resorption. Thus a localized discoidal or double discoidal definitive placenta of irregular outline is produced in the fundic half of the uterus.

Microscopic examination shows the placenta to be deciduate and to resemble most closely the type found in Carnivora. According to Grosser's terminology, it is either a placenta syndesmochorialis or endotheliochorialis representing a transition form between the two. It differs from Carnivora in the absence of border hematomata or of a conspicuous glandular layer. The widespread resorption of portions of the placenta probably supplies the fetal need for iron.

An allantoic sac does not develop. The amnion fuses early with the chorion. A small yolk sac has a brief existence. A complete membranous epitrichium encloses the fetus until birth.

Comparison of the placenta and uterus with Manis and Crycteropus further emphasizes the wide separation from those adeciduate Old-World forms. Although the placentae of the other New-World edentates (ant-eaters and armadillos) are deciduate, they differ markedly, as far as the structure is known, from that of the sloth.

65. The transformation of primitive cartilage cells into osteoblasts in the early ossification center of the patella of the dog. WALTER ZEIT (introduced by Eben J. Carey), Department of Anatomy, Marquette University.

The ossification of the cartilaginous patella in the fox-terrier puppy does not begin until five to seven weeks after birth. In the patella of a six-weeks-old fox-terrier puppy the ventrocephalic aspect has a well-defined perichondrium; the dorsocaudal aspect has the flattened articular cartilaginous cells devoid of a perichondrium. Perichondrial collagenous strands are directed into the cartilage obliquely and between these strands the continuous blood-vascular channels extend from the osteogenetic layer of the perichondrium toward the center of the patella. In seven-, eight-, and nine-weeks-old puppies the staining reaction of the matrix in many places changes from a light blue to an orange-pink. The larger blood vessels at the rim of the center of ossification are surrounded by a broad zone of orange-pink staining matrix comparable to that found in the true bony trabeculae. The cells within this matrix gradually and indefinitely blend with the outlying embryonic cellular cartilage on one side and with the proliferating endothelial cells surrounding the vascular channels on the other. The staining reaction of this young matrix cannot be differentiated from that possessed by the bony trabeculae. The contained cells, however, are morphologically cartilaginous cells. In later stages there is more degeneration and less transformation of cartilaginous cells into bone tissue.

PAPERS TO BE READ BY TITLE

1. Reticulation and age of red blood corpuscles in normal and anaemic mice. S. B. DE ABERLE, Department of Anatomy, Stanford University.

At the fifteenth day of fetal life all of the erythrocytes in the circulation show reticulation. From then on the number of cells with reticulation becomes progressively less. By the second day after birth, less than half of the cells in normal blood are reticulated, and by maturity the number is reduced to from 1 to 3 per cent. As development progresses not only does the number of cells with reticulation become less, but the amount of reticulation in those cells that do show it is also reduced. Hemoglobin determinations show an inverse relation between total hemoglobin and frequency of reticulation. In anaemic fetuses and young the reticulation in individual cells tends to be heavier than in the normal, but the same sequence of stages is encountered. Since it is apparent from the observations that each cell passes through early stages in which reticulation appears and is then lost, followed by a period in which only the hemoglobin stains, a method is afforded of estimating the relative average age in the two types of blood. By this method it appears that the erythrocytes in the blood of newborn mice suffering from hereditary anaemia have a death rate about twice as high as the corresponding cells in the blood of normal mice of the same age.

2. Reticular fibers in renal glomeruli. R. BERNARD ALLEN (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.

Zenker-fixed kidney tissue when treated according to Foot's modification of the Bielschowsky-Maresch gold-chloride technique will show reticular fibers in some glomeruli. Several normal adult human kidneys were studied by this method and fairly uniform results were obtained. The fibers in this structure, as elsewhere, are characterized by their filamentous nature, branching processes, and intracellular location. The fibers are not seen throughout the entire glomerular tuft, but are fairly sharply limited to a small central or slightly eccentric areas near the root vessels (pedicle) of the tufe. From these areas occasional fibers are seen to radiate peripherally. No constant or typical relation of reticulum cells (or their fibers) to capillary endothelium was observed. Thus far in this study it appears that cells of the reticulated variety are not essential in the morphological pattern of the tuft. The endothelial elements in the renal glomerulus apparently exist as an independent system with no reticulo-endothelial characters.

3. Cyclic changes in size of muscle fibers of the fallopian tube of the domestic sow. DAVID ANOPOLSKY (introduced by G. W. Corner), University of Rochester.

Pieces were taken from the middle of the tube, macerated in 3 per cent nitric acid, and separated by shaking. Large numbers of intact symmetrical fibers were thus isolated. From each specimen about 300 were chosen at random for measurement and the frequency-distribution of length plotted. Due precautions were taken to avoid other than random sampling. The specimens, numbering forty, were subsequently dated as to their place in the twenty-one-day-cycle by histological examination of the corresponding ovaries and uteri. All animals used had signs of previous cycles in the ovaries.

The muscle fibers were found to be largest from about the seventeenth day after the last ovulation until about the third day following the new ovulation (i.e., just before and during oestrus). Thereafter they were found to become progressively smaller, reaching minimum size between the tenth and fifteenth day after ovulation. These changes in size are, therefore, correlated in point of time with the growth of follicles and the corpora lutea and also with the cyclic changes in the contractions of the sow's fallopian tube, as shown by Seckinger some years ago. The large stage of the fibers is related to the period of small rapid contractions and the small stage is related to the period of large, slow contractions.

Similar studies on the uterus are in progress.

4. Ineffectiveness of parenteral injection of bovine pars tuberalis suspensions to influence growth or sexual function in the rat. WAYNE J. ATWELL, Department of Anatomy, University of Buffalo.

Previous studies (Atwell and Marinus, '18) have shown that extracts of the bovine pars tuberalis are greatly inferior to extracts of the pars intermedia or the neural lobe in oxytocic and pressor effects. Such oxytocic and pressor effects as are exhibited by extracts of the pars tuberalis may be ascribed to contamination from neural-stalk tissue which the pars tuberalis surrounds and from which it is with difficulty separated.

It is possible, however, to obtain pars tuberalis quite free from pars tuberalis proprior substance. Parenteral injection of emulsions of pars tuberalis three times per week for five months, beginning at twenty-eight days of age, did not materially influence body growth or sexual function in the albino rat. In one litter a treated female became pregnant and gave birth to a litter of normal healthy offspring. Microscopic examination of tissues from four treated males of the same litter showed normal testes with active spermatogenesis, normal thyroids, and adrenals.

These results demonstrate that the pars tuberalis does not participate in the most clearly demonstrated functions of the anterior lobe proper.

5. Studies on the lateral-line system of Amphibia. I. Cytology of the lateral-line organ of Necturus maculosus. HARRY A. CHARIPPER (introduced by Alden B. Dawson), Department of Biology, New York University.

This study of the lateral-line organs of Necturus was undertaken to ascertain the normal histology of these sensory structures in order to obtain a basis for comparison with histological preparations obtained from animals in which the nerve supply to the lateral-line system had been transected. The central or sensory cells are characterized by the presence of spherical granules, usually perinuclear in position, but tending to be accumulated at the proximal pole. The granules vary in size and many are in intimate contact with the nuclear membrane. No granules have been demonstrated in the elongated spindle-shaped sustentacular cells.

Both central and sustentacular cells possess epitheliofibrillae of variable size which run parallel with the long axis of the cells. They are not entirely intracellular, as many definite fibrillae can be observed in the intercellular spaces. While some fibrillae are straight, others are wavy and simulate intraepithelial nerve terminations. The nerve supply to the organs passes vertically through the

dermis to enter the base of the organ at its center. The fibers of the lateral-line nerve terminate in a scanty network around the proximal portion of the sensory cell. Silver-nitrate preparations show an impregnation of both epitheliofibrillae and nerve fibers. Accordingly, it often appears as if the nerve endings are intracellular.

6. Vascularity in the spinal cord and hindbrain of the dogfish (Squalus sucklii). E. Horne Craigie, Department of Biology, University of Toronto.

Measurements in eight specimens indicate that the vascularity is very much lower than in the rat, and lower even than in the ratfish (Hydrolagus). The average diameter of the capillaries is somewhat greater than in the ratfish, and considerably greater than in the rat.

As in the ratfish, the lateral-line lobe is the richest region examined, and other representatives of the acustico-latero-cerebellar group come next, the lagenar area only being relatively poor. The acustico-latero-cerebellar regions do not surpass the other parts in vascular richness nearly so much as in the ratfish, the series of centers studied, when plotted in order of increasing vascularity, forming nearly a straight line.

As in the ratfish, the lateral funiculus of the spinal cord is richer than the poorest gray centers. Unlike the ratfish and the rat, however, the dogfish has visceral centers which exceed the poorer somatic areas in capillary supply, the relative richness of the motor X nucleus being particularly noticeable.

7. The nature of homology in muscles (extensor carpi radialis). C. H. Danforth, Department of Anatomy, Stanford University.

Mm. extensores carpi radiales have been studied in several forms by means of dissection and in embryological preparations. Within the same species (e.g., mouse or man) there is a considerable degree of constancy in the form and configuration of these muscles and, to some extent, in their major subdivisions. But this constancy becomes less marked as the comparison is carried to finer details. If the results are correctly interpreted, a series of homologous muscles from animals of the same species might be likened to a row of houses all built on the same plan and of similar material, but with no special attempt at arranging individual units in the same manner. In other words, two muscles are not homologous because their constituent parts are homologous, but because they are both composed of cells with a similar 'reaction pattern.' Previous studies on hair indicate that similar relations obtain for the pilary system, and this may possibly be regarded as a general principle of morphogenesis.

8. A gynandromorph mouse. C. H. Danforth, Department of Anatomy, Stanford University.

This mouse has a well-developed left ovary with large follicles and abundant liquor folliculi. There is a normal uterine tube and left cornu. The latter contains a ball of cornified epithelium, apparently forced back from the constricted vagina. The right gonad is a testis showing all the early stages of spermatogenesis, but with only a few mature spermatozoa (possibly because of partial cryptorchism). The right ductus deferens and seminal vesicle are normal. The relations of urethra and vagina are aberrant with a few prostatic ducts on the female side. This specimen is of value for purposes of comparison with freemartins and individuals subjected to gonadial grafts.

9. Distribution of foetuses in the uteri of mice. C. H. Danforth and S. B. de Aberle, Department of Anatomy, Stanford University.

Four hundred and nineteen mouse uteri contained a total of 2625 foetuses; 1333 were on the left side, 1292 on the right. The number of young in a single horn of the uterus ranged from 0 to 9. An analysis of the data for litters of various sizes showed that the distribution of foetuses between the two horns of the uterus followed the 'laws of chance' with remarkable closeness. This points to some underlying factor or factors regulating the number of foetuses that can be produced at any given time, for a chance distribution indicates that the two sides are not independent. If the two sides were free from any mutual interaction, the distribution of foetuses should be prevailingly symmetrical instead of 'random.' The situation is apparently not due to differential death rates, since early stages and dead embryos were counted. The observed relation might be approximated if the two sides showed an imperfect alternation of function. They would be exactly met if the organism, as a whole, contributed at any given time an impulse only adequate for the maturation of a definitely limited number of ova, so that if more developed in one ovary there would necessarily be less in the other. This is in accord with compensatory increase of function following the removal of an ovary, and is thus in harmony with experimental results.

10. Modified lymph nodes from dogs with a known history of irradiation. Alden B. Dawson, Department of Biology, New York University.

A pyloric and a mesenteric node were removed from each of three dogs previously irradiated over the right lower abdomen. Dog 1 received a two-and-one-half human erythema dose of medium wave length and died twenty-three days later. Dogs 2 and 3 received 75 per cent of a human erythema of short wave length. Dog 2 died 102 days, and dog 3 was killed 242 days after exposure. Both nodes from dog 1 were strikingly similar to the lymph node of a rabbit described by Jordan ('26) in which he found transformation of lymphocytes into erythroblasts. In the other four nodes the normal pattern was not so greatly modified; but there is definite evidence of similar transformation of lymphocytes. At one pole of the pyloric node of dog 2, two afferent lymphatics can be recognized. They are distended, filled with a precipitate and scattered leucocytes, and can be traced to the peripheral sinus. Near the connection with the sinus the cortex is characterized by many large clear spaces, probably dilated lymph capillaries. No afferent vessels were found. Other modified nodes, described later in 1926 by Jordan, gave evidences of a reaction presumably resulting from some unknown but widespread irritation. It is suggested that irradiation, while not acting as a specific agent to induce transformation of a node, may produce vascular stasis, favorable for such a transformation.

11. Experimental studies on retarded development of the single cell—Paramecium caudatum. C. F. De Garis, Department of Anatomy, Johns Hopkins University.

The process of cell division in Paramecium caudatum may be retarded by noxious environmental conditions in such a way that the partially divided organism, when restored to normal conditions, can no longer complete the division.

The conjoined halves, however, continue to grow as components of a double monster. Such a monster may survive for fifteen to twenty days, during which time one or both components may give rise to further conjoined segments or, as frequently happens, to more or less distorted or even normal detached forms.

The detached forms, if at first abnormal, either fail to divide and after a few days perish, or, as is usually the case, eventually become regulated through a series of divisions into perfectly normal forms. These normal forms produce normal progeny, no matter how grossly distorted may have been the monster from which they arose. Thus far these experiments have conspicuously failed to demonstrate the inheritance of acquired abnormalities.

The monstrous forms are produced as the coincident result of, 1) a retarding agent operating at, 2) a critical period of development over, 3) an effective period of time. The effective period of time varies widely with the retarding agent, being short with cyanide and long with alcohol. The several retarding agents used are, 1) low temperature (3° to 8°C.) and the following vapors: 2) cyanide, 3) ethyl alcohol, 4) formalin, 5) chloroform, 6) ether.

12. The cloaca and spermatheca of Gyrinophilus porphyriticus females. JOHANNA M. DIECKMANN (introduced by Wayne J. Atwell), Department of Anatomy, University of Buffalo.

The spermatheca in adults consists of an aggregation of flask-shaped tubules extending caudally from a forked common tube, which opens into a slit in a middorsal papilla. The entire structure is surrounded by muscle and pigment cells. The cloaca shows also ventral glands and a diverticulum extending into the base of the papilla from the caudal side. Sperms were abundantly present in June, August, and November; apparently they are stored from fall until ovulation in the following spring or summer.

In young animals at metamorphosis tubules first appear as cord-like outgrowths from a depression in the dorsal wall of the cloaca. This depression elongates into the common tube. The latter therefore represents a modified portion of the cloaca rather than an epithelial outgrowth. Gyrinophilus diverges from the primitive form (Necturus) in this modification during ontogeny of a cloacal area into a common spermathecal tube. The Plethodons and Desmognathus, with the spermathecal tubules reduced to but four to six, represent a greater degree of modification. During development, coincident with elongation of the whole cloaca and development of the papilla and diverticulum, the tubules change their direction to point caudally.

13. The cloaca and spermatheca of Hemidactylium scutatum females. JOHANNA M. DIECKMANN (introduced by Wayne J. Atwell), Department of Anatomy, University of Buffalo.

The spermathecal tubules, which are branched in this form, are reduced in number to three or four on each side, and open separately into a middorsal slit in the cloaca. Their openings are confined to the extreme cephalic portion of the slit. The slit extends the entire length of a middorsal elevation, which is not sufficiently developed caudally to be called a papilla, as in Gyrinophilus; nor is there a dorsal diverticulum. Ventral glands are absent. Dorsal glands are rudimentary and occur in three groups—two caudal and one cephalic to the

spermatheca. Hemidactylium, though showing the reduction in number of tubules characteristic of the Plethodons, nevertheless retains the primitive form of spermatheca (as in Necturus), in which tubules open separately into the cloacal chamber. This is in contrast to Gyrinophilus, in which a common tube has been developed.

14. A study of nerve regeneration through a transplant and the avoidance of neuroma formation by secondary resection. Leslie W. Dowd (introduced by L. B. Arey), Northwestern University Medical School.

In nerve transplants the neuroma-bulb formation is limited to the distal end of the proximal stump and is composed almost wholly of nerve tissue in the form of interlacing fibers which have grown down to the scar. At the distal end of the transplant there is no bulbous enlargement and the nerve fibers pass onward with relatively little distortion.

Both myelinated and unmyelinated nerves develop new axis cylinders of myelinated fibers. The regeneration is by a lateral branching of new fibers from the undegenerated portion of the nerve about 5 mm. above the cut end, while in the case of the unmyelinated fibers the new axis cylinders develop about 2 cm. above the cut end. These new branches have no myelin sheaths and proceed distally in an attempt to make a functional termination. Scar-tissue formation is the greatest obstacle to this attempt, for by the time the regenerating fibers have reached the site of nerve anastomosis connective tissue has already become well established. Experiments are in progress to test the practical value of resecting the proximal scar at about the time the new fibers have reached that point and so permit the fibers to pass before new connective tissue establishes an effective barrier.

15. Relationship of vagus fibers to the sympathetic trunk and splanchnic nerves. Donald Duncan (introduced by A. T. Rasmussen), Department of Anatomy, University of Minnesota.

Iwama's report that in the cat many medullated fibers from the right vagus regularly course in the sympathetic trunk and splanchnic nerves (entering the sympathetic trunk in the region of the inferior cervical sympathetic ganglion) calls into question the validity of much of the physiology which is based upon experimental stimulation of the vagus and splanchnic nerves.

In checking these observations we have cut the right vagus of cats, dogs, and rabbits in the midcervical region and, by means of the Marchi method, examined particularly the sympathetic trunk and splanchnic nerves. Out of five cats only one shows a few degenerated fibers in the right sympathetic trunk and corresponding splanchnic nerve. Out of four dogs two are doubtful because of precipitate. One is negative and one clearly shows many fine degenerated fibers in the right ansa subclavia, right thoracic sympathetic trunk, and about thirty such fibers in the corresponding splanchnic nerve. Rabbits so far have been negative.

Apparently in these animals there is no constant bundle of medullated fibers from the cervical portion of the vagus entering the sympathetic trunk, at least below the level of the thyroid cartilage.

The work is being continued so as to include an investigation of the non-medullated fibers as well.

16. Leucocyte reaction to normal serum, inanition serum, and liver extract. V. E. Emmel and M. H. Streicher, University of Illinois.

In the present investigation experiments were instituted on a series of male albino rats under standard nutritive conditions designed to further extend our previous study on the leucocyte reaction to inanition factors (Anat. Rec., vol. 29, p. 397, 1925; vol. 32, p. 231, 1926; Am. Jour. Anat., vol. 38, 1926).

The present data may be briefly summarized as follows: *a*) In confirmation of previous results the lymphocyte-neutrophile ratio after intraperitoneal injection of normal serum remained essentially constant (fifteen animals). *b*) In contrast to this, upon injection of inanition serum the neutrophile differential count was increased by an average of about 145 per cent (twelve animals). *c*) Alcoholic liver-extract (with a minimum protein content) injection. Four animals gave an increase in the neutrophile differential count of approximately 150 per cent.

The question to what extent the liver is a contributing factor to the leucocyte reaction in inanition is under investigation.

17. A new epithelial sensory organ in the vaginal mucosa of the dog. Herbert M. Evans, University of California.

At particular localities in the dog's vaginal canal, occupying areas of from 3 to 5 mm. or more, the epithelium is higher and characteristically changed. The presence of such sensory localities in the epithelium is plainly evident at the time of oestrum, when the whole vaginal mucosa is higher—a high stratified squamous structure—for the still higher epithelium of the sensory district is seen to consist chiefly of cells whose long axis is perpendicular rather than parallel to the basement membrane. So attenuated are these epithelial cells that their nuclei are long rods resembling smooth muscle nuclei, or, indeed, may be thread-like structures. Such a mucosa is entered by small cables of nerve fibers which immediately subdivide to spin an elaborate fibrillar plexus about each epithelial element; the net-work stains deeply with iron haematoxylin after fixation with Bouin's fluid at 38°C.

18. Resemblance of litter-mates in the degree of response to anterior hypophyseal fluid. Herbert M. Evans and Miriam E. Simpson, University of California.

Litter-mate brother or sister rats resemble one another more closely than do random picks in the abnormal growth which may be induced by a standard dosage with anterior hypophyseal fluid; very sensitive and very refractory litters are found. We have encountered two litters exhibiting complete absence of response even with massive dosage with the hormone. In both cases normal growth was not disturbed, but accelerated growth or ovulation disturbance could not be induced by repeated trial with various levels of dosage with extracts of marked potency.

19. Experimental gigantism—differential effect of anterior hypophyseal extract on normal and gonadectomized males and females. Herbert M. Evans and Miriam E. Simpson, University of California.

Groups of litter-mate brother and sister rats have been constituted by placing in each group normal untreated, gonadectomized untreated, normal treated, and

gonadectomized treated animals. The treated animals received intraperitoneally daily beginning with the twenty-first day of life 1 cc. of the supernatant fluid from a centrifuged neutralized alkaline extract of the anterior hypophysis of beeves. Without treatment, the gonadectomized female is heavier than her control, the gonadectomized male lighter than his control. The same relations are shown when overgrowth is stimulated, the sequence from heavier to lighter animals being: normal males treated, gonadectomized males treated, gonadectomized females treated, and normal females treated. The marked early plateauing of the female growth curve produces a greater contrast at the two hundredth day of life between treated and untreated females than with males at this time.

20. An analytical study of regeneration in the gastric mucosa of the dog. ARTHUR N. FERGUSON (introduced by L. B. Arey), Northwestern University Medical School.

It is known that the gastric mucosa of the dog regenerates after small pieces are excised. An analytical study of this regenerating epithelium should throw some light on the replacement of cells in the adult gastric glands and furnish interesting comparisons with the primary histogenesis of these elements in the embryo.

Large pieces of the mucosa of the body of the stomach were excised and specimens of regenerating epithelium from one week to four months obtained. This new epithelium was then studied histologically and the cell types involved identified by means of differential stains and structural characteristics.

Results. Shortly after the injury, only mucous chief cells are present at the margin of the lesion. From these a layer of more or less undifferentiated flattened epithelium grows out and eventually covers the floor of the lesion. This flattened epithelium then becomes cuboidal and takes on the characteristics of mucous chief cells. By multiplication of these cells the new epithelium is thrown into folds, and gland anlages are formed. Subsequently, parietal and serous chief cells are differentiated from these mucous chief cells and the picture of an adult gastric gland is completed. Thus it is seen that mucous chief cells are capable of giving rise either to more mucous chief cells or, by further differentiation, they may transform into parietal cells or serous chief cells.

21. The striatum in the rat. ELISHA S. GURDJIAN, Department of Anatomy, University of Michigan.

This consists of the caudate nucleus, the nucleus accumbens, the putamen, the globus pallidus, and the amygdala.

The caudate nucleus is undifferentiable from the putamen in the rat. In fact, the former is the cephalic continuation of the latter. The caudate is not traceable posteriorly on the medial aspect of the internal capsule in this form.

The nucleus accumbens is continuous with the head of the caudate and made up of the same type of cells. It is connected with olfactory centers further in front and the hypothalamus posteriorly.

The putamen forms an elongated oval mass traceable as far back as the plane of the middle third of the amygdaloid complex. It is made up of small cells.

The globus pallidus in the rat is a scattered nuclear mass made up of small and large cells. It is very small in this form.

The amygdala is made up of seven nuclear masses. Some of the fibers in the stria terminalis are traceable to the cortex adjacent to the hippocampus. Extensive connections exist between the amygdala and the hypothalamus. In the rat the amygdalohabenular connection is practically negligible. Connections between the amygdala and the pyriform cortex, the amygdala and the olfactory centers further in front, also exist.

22. Complete situs inversus of the vena cava superior. BÉLA HALPERT, Department of Anatomy, Johns Hopkins University.

Complete situs inversus of the vena cava superior was observed in a two-months-old colored baby. The right vena cava superior was entirely absent, being replaced by the left which extended from the junction of the venae anonymae (of which the right was the longer) in front of the aorta and arteria pulmonalis to join the sinus coronarius. The greatly enlarged coronary sinus was otherwise normal. No vestige of a right vena cava superior was found, nor was there a vena azygos on this side. A large venous trunk emptied into the vena cava superior sinistra exactly as would the vena azygos into the normal superior vena cava. The size of the right and left venae jugulares internae was about the same, although the sinus sagittalis superior emptied into the left sinus transversus. No other deviation from the usual was found in the rest of the tributaries of the superior vena cava. The course of the vena cava inferior and its tributaries was normal. A comprehensive analysis of the available literature has shown that a complete situs inversus of the vena cava superior and its tributaries is a comparatively rare anomaly.

23. A note on the distribution of blood vessels in the wall of the human gall bladder. BÉLA HALPERT, Department of Anatomy, Johns Hopkins University.

The 'neurovascular bundle' formed by the cystic artery, cystic vein, lymphatics, and fairly large nerves runs usually straight across the curves of the cystic duct and the neck of the gall bladder. The main branches then are distributed for the most part near the margin of the free surface along, and parallel to, the right and left borders of the fossa vesicae felleae. The main branches of the structures forming the 'neurovascular bundle' as well as the trunks themselves lie immediately beneath the serosa (plexus subserosus). In the perimuscular layer just beneath the muscularis there occurs a rich plexus of medium-sized blood vessels (plexus perimuscularis). In the zone of this vascular plexus the perimuscularis appears somewhat denser than it does toward the periphery where it is loose, less cellular, and often contains fat-cells. A third plexus consisting of a very rich net of small blood vessels is found in the mucosa (plexus subepithelialis).

24. Absorption of methylene blue from the air chamber of the incubating hen's egg. E. B. HANAN (introduced by Wayne J. Atwell), University of Buffalo.

Studies on the absorption of trypan blue, by the fetal membranes of the chick, previously described by the author, suggested that it would be of interest to test the absorption of a crystalline substance by the fetal chick tissues. Utilizing the same procedure, a number of eggs were injected with methylene blue on the ninth day of incubation. Each egg was injected with 0.5 cc. of a 0.25

per cent solution and opened twelve hours later. Their contents were examined macroscopically and with the aid of the binocular microscope.

The staining of the fetal fluids, membranes, yolk, and albumen was similar to that described for trypan blue, but staining of the embryo was different. The somatic tissues were unstained. The left jugular lymph sac usually contained a light blue fluid. On examination of the viscera, the gall bladder and the lumen of the proventriculus contained methylene blue, the dye having reached the intestinal lumen by way of the biliary tract. The spleen was always dark blue. The kidneys were unstained and no dye could be detected in any other organ or tissue.

Since methylene blue may be reduced to a leuco base in living tissues and must be reoxidized in order to be detected, the embryos and the amniotic fluids were exposed to air in a moist chamber. In from twenty-four to thirty-six hours the central nervous system showed a light blue stain. The amniotic fluid remained clear.

Further experiments and histological studies are in progress.

25. Is the supposed long life of the bat spermatozoa fact or fable? CARL HARTMAN, Carnegie Laboratory of Embryology, Baltimore, and W. KENNETH CUYLER, Museum of Natural History, Cleveland.

Several years' collection at Austin, Texas, has yielded genital tracts of two species of bats from every month of the year. In the house-inhabiting Nyctinomus mexicanus there are no spermatozoa in the uterus of the female nor the testis or genital tract of the male except in the limited breeding season (March). The female of the cave-inhabiting Myotis (sp?) harbors live spermatozoa throughout the winter; but the male of the species has living spermatozoa in the epididymis throughout the winter. In neither species are the sexes thoroughly segregated at any season.

With one exception, every recorded observation of the sexual habits of bats can be better explained on the assumption of repeated coitus throughout the winter. The exception is Grosser's description of atresia of the vagina in Vesperugo (Anat. Gesellschaft, 1903) where despite the atresia living spermatozoa were found in the uterus. Should this phenomenon be corroborated (but not until then), we should have to concede as established the now generally accepted explanation of autumnal copulation and vernal fertilization in certain Cheiroptera.

26. Certain hitherto undescribed forms of epithelial invagination occurring in the chorion of the pig. CHESTER H. HEUSER, Department of Embryology, Carnegie Institution of Washington, Baltimore, Maryland.

In addition to the well-known areolae, there are epithelial structures in the form of pits, vesicles, and cysts which have been found in all later stages of the pig's chorion. The pits are either shallow depressions opening wide upon the uterine surface of the chorion or they are pockets pushing deeper into the chorionic wall. The vesicles and cysts have either wide ducts opening on the surface or they may be very slender. An occasional duct has just closed at its distal end by a solid group of cells which fuse with those of the surface epithelium. The pits and wide-open vesicles are lined with active cells, whereas the

walls of the closed vesicles and cysts are thinner and made up of low darkly staining cells. They are all completely enveloped by a close-meshed capillary net.

The chorion of the 138-mm. embryo contains about 300 pits and vesicles which are scattered over the whole chorion, except at the poles. They vary in diameter from 0.25 to 5.0 mm. or more.

The vesicles possibly arise as enlargements of the intervillous fossae, or occasionally by the expansion of a space between the alveolar tufts. These structures appear to grade into each other and the young ones seem to be functional, whereas later they become less active and even cystic.

27. The differentiation of isolated parts of rat embryos when transplanted to chick embryos. Y. K. Hiraiwa and B. H. Willier, Department of Zoölogy, University of Chicago.

Albino rat embryos (3 mm. long) eleven days old were isolated from the surrounding decidua and membranes, and cut into three parts, each about 1 mm. in length. Each part was then grafted to the chorio-allantoic membrane of a nine-day chick embryo and permitted to grow for nine days, when the graft was removed and examined histologically.

Thus far nineteen grafts (nine of anterior third, six of middle third, four of posterior third) have been examined. Cartilage and bone are very commonly present in grafts of all three levels. Nerve tissue (much of which is unorganized and some differentiated into ganglia and brain wall) and skin (showing many fully differentiated hair follicles bearing hairs; also skin glands) are present only in grafts of the anterior and middle thirds. The mesonephros was found only in grafts of the middle third. In general, it is clear that cartilage, bone, skin, and, in some instances, muscles and mesonephros are well differentiated, while nerve structures and entodermal derivatives are either less well differentiated or absent.

Such results will enable us to make a study of, 1) the organization of rat embryos—and of mammalian embryos in general—at various stages of development and, 2) the possible effects of a foreign host embryo, such as the chick, upon the differentiation of organ primordia of the rat embryo—and especially the differential survival of the various organ primordia in the grafts.

28. The fate of the primordial germ cells of Amblystoma in grafts implanted in the somatopleure of other embryos. R. R. Humphrey, Department of Anatomy, University of Buffalo.

The graft removed for transplantation consisted of a narrow strip extending in the direction of the wolffian duct and lying between the levels of the eighth and sixteenth somites. It included a part of the wolffian duct together with the associated mesodermal cells known to become primordial germ cells, as well as small amounts of mesoderm from the edges of the adjacent somites and lateral mesoderm; these were all removed attached to the overlying ectoderm and transferred to the lateral body wall of an embryo from which a suitable area of ectoderm and mesoderm had been removed. Host embryos were of stages 30 to 35; donors were at stages 30 to 32, in which germ cells are still much like neighboring mesodermal cells.

Of seven embryos surviving the implantation, five show primordial germ cells in the graft comparable in differentiation to the germ cells in their own gonads

(host and donor were approximately equal in age at operation). In the host reared to the greatest age (forty-four days), the germ cells of the graft were increasing in number by mitosis, and formed a gonad of considerable size, which, together with a fat-body, bridged the coelome from body wall to mesentery.

These results indicate that primordial germ cells of Amblystoma may survive, differentiate, and produce an ectopic gonad, even when transplanted before they become morphologically recognizable.

29. Modification or suppression of the so-called migration of primordial germ cells in anuran embryos. R. R. HUMPHREY, Department of Anatomy, University of Buffalo.

Primordial germ cells of anurans are included in the entoderm forming the roof of the archenteron; here, before their separation from the entoderm, they form a prominent ridge, their arrangement in which probably facilitates ingrowth of the lateral mesoderm between them and the entoderm proper. Following ingrowth of the lateral mesodermal layers, the formation and elongation of the mesentery further separates germ cells from entoderm.

This separation ('migration') of germ cells from the entoderm may be modified or partially or entirely suppressed by a variety of procedures:

a. Treatment with dilute solutions of lithium chloride or mercuric chloride, beginning several hours before the germ-cell migration.

b. Reduction of oxygen supply, by keeping eggs in closed jars, beginning with late blastula stages and restoring embryos to normal conditions only after majority show necrosis.

c. Removal of the ventral two-thirds of the yolk entoderm (with overlying germ layers) in caudal half of body, leaving intact the dorsal third which includes the germ cells. Operation is performed several hours before the germ-cell migration would normally begin.

After any of the above procedures the genital ridges may be found to contain few or no primordial germ cells. Such ridges develop into sterile (or practically sterile) gonads, in which secondary germ cells appear to develop in older stages.

30. Comparative anatomical investigations on the facial musculature of the whale. ERNST HUBER, Department of Anatomy, Johns Hopkins University.

As part of an extensive research program on facial musculature, invading many fields of scientific interest, a study was made of this musculature in Cetacea and Pinnapedia, forms admirably adapted to marine life. Derived from primitive carnivore stock, the Pinnapedia, less specialized than Cetacea, offer valuable hints for the extreme specialization in whales, and hence must be included in such studies.

In whales, both platysma and sphincter colli profundus, from which all facial muscles derive, are in part found in rudimentary form, as well as some of the individual facial muscles. The presence of these muscles indicates the ground-plan of facial musculature of the whale's ancestors before adaptation to marine life.

The vitally necessary differentiation of an effective muscular apparatus for the whale's spout-hole was greatly influenced by the profound changes in its skull, as demonstrated by paleontological research. In homologizing the muscles involved, the nerve supply serves as a valuable guide, indicating the way of

differentiation. The whale has an evidently functioning orbicularis oculi muscle, and, furthermore, rudimentary ear musculature, persisting though the whale long ago lost power of hearing air-borne sounds.

As an aid to comparative anatomical and paleontological problems of mammals, facial musculature promises to be as valuable as are to-day the skull and teeth, as this musculature, a late phylogenetic acquirement, has been specialized relatively recently in various mammalian orders, to different degrees and along different lines. Even when secondarily reduced or in rudimentary form, these muscles afford material for far-reaching evolutionary conclusions.

31. Blood-cell formation in the adult turtle. H. E. Jordan and C. C. Speidel, Laboratory of Histology and Embryology, University of Virginia.

Examination of the organs of the turtle, including bone-marrow, liver, spleen, kidney, interscapular gland, and intestine, reveals that the chief locus for blood-cell differentiation is the spleen. This organ displays two regions which are conspicuously different in appearance. Arterioles surrounded by thick cords of lymphoid cells are quite sharply distinct from the regular splenic pulp and sinuses which occupy the intervening regions. These cords contain small and large lymphocytes, the former predominating. Reticular cells are present, though largely masked by the closely packed lymphocytes. There may also be seen a number of small lymphoid cells staining with a purplish tinge in Giemsa, the significance of which is not completely understood. Occasional eosinophilic granulocytes are to be seen. Mononuclear macrophages may be recognized which usually contain a few pigment granules. In the second region, that of the splenic pulp and sinuses, granulocytes are prominent. Young basophil granulocytes are numerous. These appear to differentiate both from reticular cells and from lymphocytes. Two mature types of eosinophilic granulocytes may be readily distinguished; one containing spherical granules, the other containing bacillary granules. In both types the granules are numerous and closely packed. Younger types of eosinophilic granulocytes are noticeably absent. A rare type of granulocyte with small metachromatic granules has been noted. Transition stages illustrating the transformation of lymphocytes into erythrocytes may be found, though they are not numerous. Spindle cells have been identified. These are of small size and are tentatively held to be derived from small lymphocytes.

32. The significance of Hassall's corpuscles. H. E. Jordan and Guy W. Horsley, Laboratory of Histology and Embryology, University of Virginia.

The studies of thymus transplants of young guinea-pigs by Jaffe and Plavska ('25) show that Hassall's corpuscles cannot be interpreted as remnants of entodermal duct primordia. The regenerating transplants are said to form new corpuscles by a process of hypertrophy and aggregation of ('epithelial') reticulum cells. This description agrees with the earlier claims of Hammar ('09) and others. Afanassiew ('77) believes that the concentric corpuscles represent remnants of obliterated blood vessels resulting from involution. Our study of the thymus bodies of man and rabbit gives evidence in support of this view. Concentric corpuscles arise chiefly from hypertrophied endothelial cells of precapillary arterioles and the immediately investing reticulum cells. Many of the corpuscles contain a few central red blood corpuscles. Such can be frequently

traced into continuity with an arteriole. Those with larger amounts of blood cells, predominantly lymphocytes and generally of larger size, represent dilated terminals of degenerating arterioles proximal to the first locus of obliteration or site of formation of an earlier Hassall's corpuscle. If Hassall's corpuscles actually represent in part remnants of atrophic capillaries and precapillaries, then similar structures should appear in other lymphoid organs during their involution. We have found structures closely comparable to Hassall's corpuscles in atrophic subcutaneous lymph nodes of the rabbit.

33. The ear of Amblystoma punctatum, a self-differentiating system as shown by transplantation experiments between white and pigmented embryos. HELEN W. KAAN (introduced by R. G. Harrison), New York University and Bellevue Hospital Medical College and Yale University.

In a previous paper, two series of experiments were described involving removal of half of the auditory cup of Amblystoma punctatum. The results of these showed that subsequent development of the ear was not checked by the transplantation of indifferent ectoderm into the wound area.

There still remained the question whether any of the transplanted ectoderm had become incorporated into the developing vesicle. To determine this point, the operations were repeated on embryos from a bunch of eggs without pigment, using undifferentiated ectoderm from normal brown embryos as transplants. The embryos were taken at three stages: 1) just before the thickening of sensory ectoderm; 2) with definite auditory plate; 3) during invagination of the otic cup.

Nineteen out of the twenty positive cases showed no trace of pigment in the developing vesicle. In every case pigmented cells were present in the epithelium and indicated very clearly the limits of the grafted tissue. Pigment was also present, in a number of cases, in the mesenchyme and ganglia lying directly against the walls of the vesicles. The results, therefore, are of importance in showing that if any of the ear-forming tissue is removed, subsequent development does not involve the incorporation of the overlying indifferent ectoderm. This occurs even though there is no visible indication of ear formation at the time of operation.

34. On the origin and development of the lymphatic valves. OTTO F. KAMPMEIER, Department of Anatomy, University of Illinois.

In human fetuses of 2 to 2.5 months, valves are already found at the mouths of some vessels draining into the jugular sacs and thoracic duct. By the end of the third month, their anlagen are appearing in the latter channel. By this time, too, valves have begun to manifest themselves in the peripheral lymphatics, in the case of the lower extremities, particularly in the region of the femoral trigone. At 3.5 months, the lymphatics of the body are abundantly supplied with valves—a fact in marked contrast to the condition of the veins, in which the first valves are not established before approximately 3.5 months of fetal life.

Concerning the mode of origin of the lymphatic valves, at least three modifications can be recognized: 1) The establishment of a valve at a point at which a growing capillary strikes the wall of a larger lymphatic, by the hollowing out of the actively proliferating extension of the sprout which projects obliquely along the lining of the lumen of the latter vessel. 2) The establishment by perforation of the locally thickened endothelial partition between two vessels, which by

growth have come to lie parallel and adjacent to one another. 3) The establishment of a valve by the formation and differentiation of two opposing ridges of the intima, similar to the process of venous-valve formation.

35. The development of the palatine tonsil: Calf (Bos taurus). B. F. Kingsbury and W. M. Rogers, Cornell University.

A study of the development of the palatine tonsil in the calf shows that the accepted current statement of Hammar, that the sinus tonsillaris develops from the dorsal angle of the second pharyngeal pouch, is incorrect for this form at least, and its interpretation as a branchiomeric structure is inadequate.

The palatine tonsil (calf) possesses two lobes developed about two primary recesses—the fossae tonsillares. The ventral groove of the second pouch plus a portion of the lateral border of the pharynx in this region forms the posterior tonsillar fossa. The anterior fossa arises as a depression in the pharyngeal floor cephalic to the hyoid cartilage. The dorsal angle of the second pouch loses its identity before the tonsillar fossae appear, and cannot therefore be associated with their development. The ventral part of the pouch marks the site of only the posterior fossa.

The plica intratonsillaris (Hammar) possesses value as an expression of the primarily double origin of the tonsillar fossae. The mesodermal part (lymphatic tissue) of the tonsil develops in the territory of the hyoid arch with a probable inclusion of material of third-arch origin.

The tonsil is interpreted as not intrinsically determined by second-pouch entoderm or mesodermal arch, but as due to the peculiar growth conditions of the region. The development of the palate and of Reichert's cartilage are important factors.

36. Correlated physiological and morphological studies of the development of electrically responsive areas in the cerebral cortex of the opossum. Orthello R. Langworthy, Department of Anatomy, Johns Hopkins University.

The electrically responsive areas of the opossum's cortex as delimited by stigmatic stimulation in pouch-young and adult animals have been plotted. An area for the fore-leg musculature was found posterior to the orbital sulcus, a short distance from the midline extending across the sulcus and a short distance anterior to it. A center which on stimulation elicited contraction of the facial-masticatory musculature was located anterior to the orbital sulcus and lateral to the fore-leg area posterior to the sulcus. No center for the contralateral hind leg was found. In the youngest pouch-young studied (twenty-three days old) fore-leg movements could be elicited from the cortex. No center for the facial masticatory musculature was located until the young were at least seventy-six days old.

Histological studies demonstrated that the center for the fore leg differentiates first. The motor cortex continues to develop anteriorly and laterally; these centers control the facial muscles. The orbital sulcus first develops in the fore-leg area, and rapid cellular maturation in the facial-masticatory center probably contributes largely to its ultimate growth. In adult animals it is difficult to distinguish fore leg from facial cortex by any characteristic of cellular structure. An apparent shifting of the fore-leg area during development was adequately explained by the late differentiation of the anterior portion of the motor cortex.

37. The effect of amputation of the limb buds on the development of the cerebellum in tadpoles of Hyla regilla. O. Larsell, Anatomical Laboratories, University of Oregon Medical School and Northwestern University Medical School.

The hind limb buds of Hyla regilla were amputated unilaterally and bilaterally in tadpoles of 15 to 18 mm., and the fore limb buds in other specimens at later stages. The larvae were then allowed to develop to various stages of metamorphosis—many to complete metamorphosis. They were fixed, sectioned serially, and models were constructed of several stages of experimental specimens and of corresponding stages of normal specimens. The late stages and newly metamorphosed frogs with both hind legs completely undeveloped, or nearly so, show a smaller development of the corpus cerebelli laterocaudally than normal animals of corresponding stages. Frogs with one hind leg undeveloped show a somewhat smaller cerebellum than normal, but amputation of the fore limb buds produced no effect which could be discerned by the methods employed.

38. The reactions of the lymphatic nodes of the albino rat to dyes in solution, colloidal and particulate suspension. John S. Latta, Department of Anatomy, University of Nebraska.

Five intraperitoneal injections of 1 per cent solutions were given, at daily intervals, of one of the following dyes: India ink, pyrrhol blue, congo red, aniline blue, trypan blue, trypan red, and neutral red. Lymphatic nodes from these acutely stained rats were compared with the controls.

In all cases there was an increase in the number of free macrophages in the lymph sinuses. Such increase was evidently due to transformation of reticular cells and lymphocytes lying within, bounding, or near the sinuses, for no signs of proliferative activity were found and many transitional stages were found between them and macrophages.

The dye content of these macrophages varied according to differences in their cytoplasmic staining quality, those staining deeply lavender being free of dye, those staining a pale, muddy pink being well filled. Vacuoles also were found in increasing size and number as the amount and toxicity of dye content increased. Disintegrating masses of dye-laden macrophages were also found.

In the dense lymphatic tissue a relative increase in large lymphocytes was seen. Degenerative stages leading to the formation of macrophages were found in most cases. Typical lymphocytes never contained visible dye.

These results indicate that dye phagocytosis was a process in which the cells were inactive and that the total effects on the nodes were degenerative in nature.

39. Histological changes in the suprarenal cortex of the mouse. Evelyn H. Miller (introduced by C. H. Danforth), Department of Anatomy, Stanford University.

Age changes were studied in the suprarenal glands of 168 mice of various ages. In thirty-nine of the females the two glands were removed at varying intervals in order to study the sequences and time relationships of these changes. The zona reticularis has appeared in both sexes by the third week of life. In the male it has usually disappeared by the end of the fourth week. In the

female it develops in a few days to 30 or 40 per cent of the volume of the cortex. This proportion is maintained as the gland grows. It is characterized at this time by irregular masses of cells which are smaller and more deeply staining than those of the zona fasciculata. Resorption of the zona reticularis occurs in normal nulliparous animals at between two and three months of age. A widespread vacuolization and hyperemia is followed by reduction of the zone to a narrow band of degenerating cells. The picture is similar to that presented by the well-known resorption in the cortex of human infants. No such process occurs immediately after birth in the mouse, since the zona reticularis is not present at that time. The resorption takes place well after sexual maturity and is apparently not influenced by the ovarian cycle.

40. The circulation of the normal human kidney. Robert A. Moore (introduced by F. L. Landacre), Department of Pathology, Ohio State University.

Injections have been made on thirty normal and twenty pathologic human kidneys. Janus green, gelatin carmine, and x-ray methods have been used. A method of preparing gelatin carmine, controlling the reaction by the hydrogen electrode, has been developed. The completeness of injection has been controlled by variation in the viscosity of the medium. In none of the kidneys examined have true anastomosing arcuate arteries been seen. No instances of arteriolae rectae verae have been seen. The arteriolae rectae are either direct efferent vessels of the border-zone glomeruli or continuations of the tubular capillaries. With very rare exceptions, the branches of the interlobular arteries end in glomeruli. There is a free anastomosis with the capsule for an area of 200 μ beneath the surface. In general, the efferent vessel of a glomerulus is distributed to the tubules of that glomerulus. There are anastomoses within the glomerulus.

41. The cranial musculature of the toadfish (Opsanus tau). David S. Pankratz, (introduced by Henry C. Tracy), Department of Anatomy, University of Kansas.

In general, the musculature is like that of Amia and Scomber, which has been fully described by Allis. Definite differences are: no intermandibularis; no branchiomandibularis; a long conical levator premaxillaris, inervated by the fifth nerve; seven branchiostegal rays connected by a thin layer of fascia and oblique fibers; and three pairs of triangular-shaped muscles arising from the ceratohyal and the first two branchiostegals, inserting on the proximal medial surface of the first three branchiostegals successively. The gill apparatus is composed of three pairs of branchial arches and one pair of psuedobranchials innervated by the ninth and tenth nerves. Especially well developed are the masticator muscles represented by a prominent cylindrical adductor mandibularis and two triangular-shaped external and internal pterygoid muscles. This group is innervated by the fifth-seventh nerve complex. The small pelvic fins are located anteromedially to the large pectoral fins. A short heavy median raphé connects the pelvic girdle and the clavicle. The ventral segmental muscles, separated by a median aponeurosis, connect the clavicle and pelvic girdle with the hyoid bone. This group apposes the geniohyoid in depressing the hyoid bone and the buccal floor. The large eye and long orbit are correlated with well-developed eye muscles. No retractor bulbus is present.

42. Existence of a sexual rhythm and experimental induction of heat in the dog during anoestrus. G. N. Papanicolaou and N. F. Blau, Cornell University Medical College, New York City.

The bitch is considered an anoestrous animal having annually two heat periods, each being followed by a long period of sexual inactivity. In order to decide whether the inactive period (anoestrus) is entirely arhythmical or is characterized by a succession of abortive oestruses, vaginal smears were studied through long periods of time. In two animals the whole anoestrus was carefully followed. The results showed the presence of successive rhythmical changes occurring, on the average, every 15.62 days. These atypical rhythms are characterized by minute bleeding, slight cornification, some mucous secretion, and a more accentuated cellular discharge. These changes correspond closely to the succession of events in the normal heat of the dog, being, however, less pronounced and shorter. The typical heat period, lasting over thirty days, includes about two rhythms and pregnancy, lasting sixty-three days, four rhythms.

The effect of the female-sex (follicular) hormone upon the abortive oestruses was also studied. By subcutaneous and intravenous administration of this hormone, an abortive oestrus could be accentuated and converted into a regular heat. In two instances a typical heat was induced by injections soon after the completion of a normal heat.

These experiments show that the dog is polyoestrous with some of the oestrous cycles less accentuated than others. They also indicate that heat is caused by periodic increases in the hormonic activity of the ovary.

43. Reaction of the omenta to particulate matter. C. W. M. Poynter, Department of Anatomy, University of Nebraska.

When suspensions of particulate matter are introduced into the peritoneal cavity of living animals, the particles very soon collect on the surface of the omenta. After a short time, the particles find their way through the mesothelium, probably between the cells, and fill the intercellular spaces of the subperitoneal tissue. If the particles are small (colloid), they mark a path leading to and into the veins. With the absorption of particles the omenta increase in thickness from hyperplasia and possibly metaplasia of their elements. This reaction is not exhibited in other portions of the peritoneum or its subjacent tissues; it is therefore evident that peritoneal absorption is not shared equally by all peritoneal surfaces.

Lycopoditu is an ideal substance to employ for the study of the reaction to large particles; the spores enter the omenta as readily as India ink and lend themselves admirably to the technique of section examination.

44. Histological evidence of colloid absorption directly by the blood vessels of pars anterior of the human hypophysis. A. T. Rassmussen, Department of Anatomy, University of Minnesota.

The literature indicates that colloid, indistinguishable from that which is usually surrounded by parenchymal cells of the hypophysis of man and higher animals, may also be found in the blood vessels, but it is not clear to what extent this material finds its way directly into the blood channels, especially in the anterior lobe.

By systematic exploration of every tenth section of complete series of sections of one hundred normal adult human hypophyses from cases of sudden accidental death (ninety males and ten females), discrete globules, from 1 or 2 μ to several times the diameter of red corpuscles and indistinguishable from the colloid within pseudoacini or cell cords, were found with reasonable degree of certainty in the blood vessels of the anterior lobe in only two cases (a sixty-two-year-old man and a twenty-year-old pregnant woman). In the pregnant female it was found abundantly in the sinusoids and in the veins leaving the organ. Material from this case was especially studied for evidences bearing upon the method by which the colloid gets into the sinusoids. This question, however, remains still unsettled.

In short, it appears that, at least in normal adult human male hypophyses, the presence of observable colloid within the blood vessels of the anterior lobe is relatively rare.

45. Branchiothoracic venous drainage in mammals and birds in relation to the duct of Cuvier. FRANKLIN P. REAGEN, Indiana University.

In rat embryos of 7 somites the primitive anterior cardinal vein lies in line with the median faces of the somites. The venous line is continued caudally by a neural plexus of vessels fed by dorsal aortic rami. Between the first and second somite the vessel is drained into the primitive cuvierian duct. Lateral to the second somite the posterior cardinal, with strict cranial direction, enters the duct. An umbilical vein also enters it much farther ventrally. Two small veins enter the cranial border of the duct of Cuvier. The one farther dorsal (A) drains the ventral aorta. The one more ventrally located (B) drains the mandibular arch, the thoracic wall, and the ventral aorta. Conditions similar to this can be found in bird embryos.

In the bird, vein 'A' has not been followed completely, but vein 'B' continues to drain the facial derivatives of the branchial arches and drains the neck. It seems to be the external jugular of some authors. In the mammal, vein 'B' loses its connection with the face and drains only the thorax as the internal mammary; vein 'A' drains the face, forming apparently the common facial. The identifications are not established with complete satisfaction, but the facts ascertained may be of interest to those capable of solving the problem.

46. Postrenal vena cava not an azygos homologue. FRANKLIN P. REAGEN, Department of Anatomy, Indiana University.

Coexistent with the early subcardinals of F. T. Lewis, there develops a lateral aortic plexus situated lateral to the periaortic sympathetic plexus, extending from the sixth thoracic segment to the caudal part of the lumbar region. The transverse elements of this plexus unite the bases of the posterior cardinal tributaries with the ventromedial ends of anastomoses between posterior cardinal and the early subcardinal of Lewis. Out of the longitudinal elements of the thoracic portion of this plexus a temporary longitudinal vein is resolved. It drains caudal thoracic intersegmental veins into the transverse portion of vena cava inferior. This thoracolumbar drainage has been variously mistaken for azygos and for posterior cardinal. A paraureteric vein arises within the lumbar lateral aortic plexus and contributes to the postrenal vena cava. Longitudinal part of the latter is serially homologous with thoracolumbar drainage.

Azygos veins (exclusive of posterior cardinal elements) arise for the most part from ventromedial elements within a perisympathetic plexus fed by dorsal aortic rami and drained by posterior cardinal intersegmentals. Typical azygos line lies medial to the sympathetic trunk and lateral to aortic intersegmentals. Lateral aortic plexus joins ventrolateral element of perisympathetic plexus. Typical azygos tributary passes dorsomedial to sympathetic trunk and ventral to dorsal aortic ramus.

In case of lumbar segments in which kidney migrates medial to posterior cardinal intersegmentals, vena cava could not be fusions of the latter.

47. The later development of the postrenal vena cava in man and in the Carnivor. Arthur Robinson, The University of Edinburgh, and Franklin P. Reagen, Indiana University.

Essential to interpretation of intersegmental drainage and, therefore, of vena caval development is an analysis of the dorsal aortic plexus given by L. H. Strong. Derived from the plexus is a longitudinal thoracic element described by him as lying dorsal to the dorsal aortic rami. In man the lumbar continuation of this subcentral vessel is functionally important, possessing special tributaries draining peripheral remains of posterior cardinal intersegmentals. Its tributaries lie dorsal to dorsal artic rami.

With onset of lumbar cardinal degeneration, cardinal spinal veins drain directly into paraureteric vein, then indirectly into it, first via lumbar homologue of azygos, then via lumbar subcentral. Left lumbar homologue of azygos degenerates. The right one and the subcentral persist intermittently to form common stems of lumbar intersegmental veins.

The fact of separate drainage ventral to sympathetic trunk in case of caudalmost right intersegmental indicates posterior cardinal contribution to vena cava.

In Carnivora, great ventral displacement of aorta, close approximation of sympathetic trunks and neighboring vessels, and dorsal displacement of paraureteric vessels give superficial appearance of an azygos picture. The carnivor postrenal vena cava is probably not a fused bilateral structure.

48. Homologies within the system of veins ventral to the mesonephric arteries of the rabbit embryo. Franklin P. Reagan, Department of Anatomy, Indiana University, and Margaret Tribe, King's College, London.

The earliest 'inferior subcardinals' of F. T. Lewis are undoubted homologues of his 'superior subcardinals.' They are continuous longitudinal lines ventral and medial on the wolffian body, draining the latter, the mesentery (rather indirectly), and the potential gonad. The later 'inferior subcardinals' of Lewis (and those who signified no departure from his view) are not serial homologues of his 'superior subcardinals.' They are new structures within the mesentery which drain the latter and the aortic paraganglia. They do not directly connect with the ventral element of the circumumbilical ring, but end blindly in the mesentery. They degenerate, as indicated by Hochstetter and emphasized by Lewis, apparently taking no part in the formation of the sex veins. They have no cranial homologues.

Inconspicuous true lumbar homologues of the thoracic subcardinals of Lewis continue to function in the manner stated. Their anastomoses with posterior

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cardinals dorsally receive the lateral aortic plexus. They are found at the apex of the coelomic extension between mesentery and wolffian body, or slightly lateral to it. They may represent the cardinal collaterals of McClure, though the identification is difficult.

In the rabbit the sex veins (posterior cardinal) are largely dorsal to the mesonephric arteries, whereas all vessels resembling subcardinal are ventral. An inconsequential part of the sex vein near the gonad may be derived from early subcardinal of Lewis.

Consideration of purely neutral anastomoses as subcardinal has greatly exaggerated the importance of that structure.

The term medial cardinal is suggested for designation of the 'superior' subcardinals plus their inferior homologues here suggested.

49. The presence of uterine-stimulating and melanophore-expanding substance in the hypophysis of early pig embryos. FRANKLIN F. SNYDER, University of Rochester.

Investigation of the time of first appearance of physiologically active substance in the embryonic hypophysis has been facilitated by readily available tests for functional activity. Abel found the guinea-pig uterus sensitive to pituitary tartrate 1 part in 15 billion; Fenn noted melanophore expansion in the frog with pituitary extract 1 part in 10 billion. In the present experiments, Dr. F. H. Swett hypophysectomized tadpoles, and the melanophores were observed when the animals were immersed in a bath containing finely pulverized hypophyses. Frogs were also perfused through the conus arteriosus with hypophyseal suspensions after washing out with Ringer's solution and ligating a leg for control. Tests were made with glands obtained from a single litter. In the perfused frog melanophore expansion was noted within fifteen minutes with glands from a 30-mm. litter, while controls of similarly pulverized cerebrum were negative. Observations with the isolated guinea-pig uterus were made upon eighteen litters of 28- to 85-mm. crown-rump length. The uterus contracted when a suspension of hypophyses from a 28-mm. litter was added to the Locke solution, while control suspensions of cerebrum were negative. Later stages were also positive, while earlier stages were not tried, in view of the difficulty of isolation of the hypophysis.

50. Studies of hyperthyroidism. V. Observations upon the posterior lymph hearts of thyroid-fed frog tadpoles. C. C. SPEIDEL, University of Virginia Medical School.

The behavior of the posterior lymph hearts has been studied in living tadpoles of the wood-frog (Rana sylvatica) and the tree-frog (Hyla crucifer) following administration of thyroid extract. During the first two or three days of thyroid treatment there is little significant change from the normal average pulsation rate. After three to five days with the appearance in the animals of the characteristic hyperthyroid symptoms, a marked decrease in pulsation rate of these hearts occurs, the rate dropping to about two-thirds that of the normal. Coincident with this fall, however, both respiratory rate and heart beat rate show a definite increase. In extreme hyperthyroidism, associated with metamorphic stasis, the rate of pulsation of the lymph hearts may decrease to one-half that

of the normal or even less. During the later stages of thyroid treatment it was observed in a number of cases that the most distal pair of lymph hearts ceased pulsating. In many other cases these hearts beat quite irregularly. No direct effect of the thyroid autacoid upon lymph-heart behavior is indicated in these observations. The effects above are regarded rather as results of the profound changes occurring in the tail during its resorption.

51. The weight and dimensional effects of anterior hypophyseal extract on the gonadectomized male rat. GERTRUDE VANWAGENEN, University of California.

The efficacy of fresh anterior-lobe fluid injected intraperitoneally into gonadectomized male rats was tested and the weight and length correlation made with untreated brothers. The extract was made according to the method of Evans and Long ('21). Weight was recorded at five-day intervals and every ten days measurements of nose to anus and anus to tail tip (checked by total length) were made under deep ether anaesthesia. Injected animals received 1 cc. of extract daily. Weight, body length, tail length, and total length of the injected animal were graphed with like data from other members of the litter. Correlation shows the body length, tail length, total length, and weight of the untreated male castrate to be less than like data for both the control and the injected castrate. Injection of anterior hypophyseal extract elevated the body length of the injected castrate to that of the control and has raised the weight of the injected castrate in most cases considerably above that of the control. Body weight in respect to body length is greater in the hypophyseal-treated castrate than in the control. Although the body length of the control and injected castrate is about the same, the total length of the injected castrate is greater because of the definitely greater response in tail length, giving a differential growth response of the body and tail.

52. The effect of injury to the facial nerve upon taste perception. BEATRICE WHITESIDE and O. R. BLANCHARD, Detroit College of Medicine and Surgery.

The left facial nerve was injured during a mastoid operation. The patient was seen four years later, and a typical facial paralysis was observed.

All parts of the tongue were tested for gustatory sensations. The right side was normal. The tip of the tongue, even a little to the left of the median line, was normal, showing an overlapping of the right chorda tympani. The left lateral part of the tongue had lost the sensation of taste. This area extended over anterior two-thirds of tongue. The foliate and vallate papillae on left side were normal.

Many cases have been reported of injury to the facial nerve, where the chorda tympani must have been involved, as there was loss of taste. There is, however, a great variation as to the exact part of the tongue affected and as to the question of the return of taste. The present case is described because there is a definite area where taste sensations are abolished, which corresponds to the part of the tongue where the taste buds, according to most investigators, are supplied exclusively by the left chorda tympani. The loss of taste appears in this case to be permanent.

53. On the placentation of the Simiae. GEORGE B. WISLOCKI, Department of Anatomy, Johns Hopkins University.

The efforts of the earlier placentologists were bent upon establishing the similarity of the placentation of the lower groups of Simiae and man. Selenka was the first to recognize that implantation and the early development of some of the Old-World monkeys differ materially from that of man. Subsequently, Strahl and Heape and Wislocki, studying several groups of platyrrhine monkeys (Cebus, Alouatta, and Ateles), showed that the structure of their placentae is markedly different from that of the catarrhines hitherto described. In the platyrrhines the mature placenta is trabeculated and labyrinthine; there are no free villi; the initial pattern and subsequent growth of the trophoblast and ingrowth of the mesoderm differs from that observed in anthropoids, so that trabeculae and intertrabecular spaces take the place of villi and intervillous spaces.

Recently, Coventry described a Guinea baboon in which the placental labyrinth is not completely villous, but is in part composed of anastomosing strands of syncytium. Meanwhile, Grosser and Wislocki have discovered the same arrangement in two other groups of catarrhines (Cercocebus and Colobus). These observations are important because they demonstrate that the Old-World forms are not all alike, either in their early development, as Strahl has shown, or in the architecture of the mature placenta. Wislocki believes that these forms represent transition types between the labyrinthine, trabeculated placentae or platyrrhines, and the villous ones found in anthropoids.

DEMONSTRATIONS

1. *Microscopic sections and microphotographs, to illustrate the postnatal growth of the vomeronasal organ in the albino rat.* WILLIAM H. F. ADDISON and L. RADEMAKER, University of Pennsylvania.
2. *Models of human renal glomeruli in chronic glomerulonephritis, illustrating the form, size, and lobulation of the structures.* R. BERNARD ALLEN (introduced by R. E. Scammon), Departments of Anatomy and Pathology, University of Minnesota.
3. *Features in the comparative anatomy of the lips and the labial villi.* BARRY J. ANSON, Northwestern University Medical School.
4. *a) The human bronchial tree, 1) at rest, 2) at the end of costal inspiration, and, 3) at the end of diaphragmatic inspiration, as shown by roentgenograms taken after the injection of iodized oil. b) A new method of handling cross-sections. c) A new technique in making plate models. d) The use of the fluoroscope and roentgenograms in gross anatomy. An exhibit of the teaching material used at the University of Cincinnati. e) Fascia endoabdominalis; a dissection suggesting the necessity for this term. f) Differences in the margo vertebralis scapulae in an individual with an amputation distal to the articulatio cubitii. g) Motion pictures: 1) Dysostosis cleidocranialis, 2) Mm. sternales. 3) Diaphragma as a retractor of the arcus costarum. 4) Hypermobility of the articulatio humero-ulnaris.* O. V. BATSON, Department of Anatomy, University of Cincinnati.
5. *A new method of determining the surface area of the body by means of plaster-of Paris casts of the living.* EDITH BOYD and R. E. SCAMMON, Institute of Child Welfare and Department of Anatomy, University of Minnesota.

6. *Graphs, charts, and specimens illustrating the growth of the thymus in infancy and early childhood.* EDITH BOYD (introduced by R. E. Scammon), Departments of Anatomy and Pathology, University of Minnesota.

7. *Cholecystograms, models, and charts illustrating the sex differences in the contraction rate of the human gall bladder.* EDWARD A. BOYDEN, Department of Anatomy, University of Illinois.

8. *Microscopic sections and photomicrographs of patellae of puppies depicting advancing stages of normal ossification.* EBEN J. CAREY and WALTER ZEIT, Department of Anatomy, Marquette University.

9. *X-ray pictures, photomicrographs, and microscopic sections of regenerated patellae of puppies.* EBEN J. CAREY, WALTER ZEIT, and BERNARD F. MCGRATH, Department of Anatomy and Surgical Laboratories, Marquette University.

10. *The arteriae carotides of the seal (Calorrhinus alascanus). X-ray films and dissections.* A. G. CARMEL (introduced by O. V. Batson), Department of Anatomy, University of Cincinnati.

11. *Microscopic sections through fractures in albino rats.* SIMON B. CHANDLER (introduced by R. M. Strong), Loyola University School of Medicine, Chicago.

12. *Demonstration of rubber models. a) Human manikin, life-size, in part or complete(?). b) Obstetrical model. c) Three casts taken from Ziegler's models.* LOYAL CLARK (introduced by William F. Allen), Department of Anatomy, University of Oregon.

13. *A gynandromorph mouse.* C. H. DANFORTH, Department of Anatomy, Stanford University.

14. *Stages in the development of the spermatheca in Gyrinophilus porphyriticus.* JOHANNA M. DIECKMAN (introduced by Wayne J. Atwell), Department of Anatomy, University of Buffalo.

15. *Models showing volumetric relations between the cortex and medulla in the adrenal glands of white and gray rats.* JOHN C. DONALDSON, Department of Anatomy, University of Pittsburgh.

16. *A new epithelial sensory organ in the vaginal mucosa of the dog.* HERBERT M. EVANS, University of California.

17. *Regeneration in the gastric mucosa of the dog.* ARTHUR N. FERGUSON (introduced by L. B. Arey), Northwestern University Medical School.

18. *Photomicrographs of various stages in the process of repair of flat bones (skull and scapula of rabbit).* F. D. GEIST, Department of Anatomy, University of Wisconsin.

19. *Application of the pyridine-silver method to the nerve supply of muscle.* J. C. HINSEY (introduced by S. W. Ranson), Washington University, St. Louis.

20. *Transection of the spinal cord in rats of various ages.* DAVENPORT HOOKER, Department of Anatomy, University of Pittsburgh.

21. *Genital ridges or gonads in Rana larvae following partial or complete suppression of the 'migration' of the primordial germ cells.* R. R. HUMPHREY, Department of Anatomy, University of Buffalo.

22. *Microscopical preparations of lymph nodes of the rabbit.* H. E. JORDAN and J. B. LOOPER, Laboratory of Histology and Embryology, University of Virginia.

23. *Microscopical preparations of the spleen of the turtle.* H. E. JORDAN and C. C. SPEIDEL, Laboratory of Histology and Embryology, University of Virginia.

24. New and complete demonstrations of the relations of the lymph hearts to lymph vessels and veins, etc., in young urodele amphibian larvae (injected specimens and drawings). HENRY MCE. KNOWER, University of Alabama.

25. Unmyelinated nerve fibers in preparations of muscles of the extremities following degeneration of the somatic nerves. ALBERT KUNTZ, Saint Louis University School of Medicine.

26. Preparations to show changes in form of the elastic tissue of the lung in the processes of inflation and deflation. CHARLES C. MACKLIN, Medical School, University of Western Ontario.

27. Tables and graphic constructions illustrating a quantitative method of determining points and areas of abnormal growth in simple and compound human monsters. CHARLES H. MEAD (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.

28. The circulation of the normal human kidney. ROBERT A. MOORE (introduced by F. L. Landacre), Department of Pathology, Ohio State University.

29. Plates of drawings of the cranial musculature of the toadfish (Opsanus tau). DAVID S. PANKRATZ (introduced by Henry C. Tracy), Department of Anatomy, University of Kansas.

30. Microscopic sections showing the reaction of the great omentum to lycopodium. C. W. M. POYNTER, Department of Anatomy, University of Nebraska.

31. Demonstration of growing tissues as seen in a transparent chamber introduced into a rabbit's ear. J. C. SANDISON (introduced by E. R. Clark), Department of Anatomy, School of Medicine, University of Pennsylvania.

32. a) Graphs and tables illustrating a quantitative study of the operation of the 'law of developmental direction' in the growth of the human fetus. b) Graphs and tables illustrating the absolute and relative velocities and accelerations of lineal and ponderal growth of the human body in fetal life and infancy. R. E. SCAMMON, Department of Anatomy and Institute of Child Welfare, University of Minnesota.

33. The results of skin grafts, with and without lateral-line sense organs, obtained in Diemyctylus viridescens. L. S. STONE, Yale University, School of Medicine.

34. a) Roentgenograms of a young orang-utan (probably between the first and second year). b) A patent foramen ovale in an adult heart. c) A pulmonary vein opening into an innominate in an adult. WALTER E. SULLIVAN, Department of Anatomy, University of Wisconsin.

35. a) Teaching of 10-mm. pig embryo. b) Reconstruction of entodermal tract of 10-mm. pig embryo. JOSEPH M. THURINGER, School of Medicine, University of Oklahoma.

36. Peristalsis in the large bowel. T. WINGATE TODD, Department of Anatomy, Western Reserve University.

37. Graphs and charts illustrating the growth of the arterial system in the human fetus. CHARLES H. WATKINS (introduced by R. E. Scammon), Department of Anatomy, University of Minnesota.

38. Microscopical preparations showing the innervation of the taste buds in the vallate and foliate papillae of the rat. BEATRICE WHITESIDE, Detroit College of Medicine and Surgery.